BROOKLYN BOTANIC GARDEN

RECORD

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EDITED BY

C. STUART GAGER

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THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

BROOKLYN BOTANIC GARDEN

RECORD

VOL. XIII January, 1924 No. 1

PROSPECTUS, 1924

I. COOPERATION WITH LOCAL SCHOOLS

The Brooklyn Botanic Garden aims to cooperate in every practicable way with the public and private schools of Greater New York in all matters relating to the study of plants. The purpose of the Garden in this connection is to supplement and enrich the school work in the way of instruction, demonstration, study material, etc., which otherwise would not be available.

Geography classes, as well as classes in nature study and botany, are finding the collection of useful plants in the economic plant house, and also our Japanese Garden, valuable adjuncts to their class work. Arrangements may be made by teachers of geography to have their classes study these collections under the guidance of a docent. Illustrated lectures for geography classes may also be arranged for at the Garden.

A. Talks at Schools.—The principals of public or private schools may arrange to have lantern talks given at the schools on various topics related to nature study, such as garden work with children, tree planting, and Arbor Day. If an illustrated lecture is desired, the lantern and operator must be provided by the school, but slides will be furnished by the Botanic Garden. Address the *Curator of Elementary Instruction* for list of talks and for appointments.

B. School Classes at the Garden.—(*a*) Schools not provided

with a stereopticon may arrange for classes, accompanied by their teachers, to come to the Botanic Garden for lectures either by the teacher or by a member of the Garden Staff.

(*b*) Notice of such a visit should be sent at least *one week* previous to the date on which a talk is desired. These talks will be illustrated by lantern slides, and by the conservatory collection of useful plants from the tropics and subtropics. Spring and fall announcements of topics will be issued during 1924.

(*c*) The Garden equipment, including greenhouses, plant material, lecture rooms, lantern and slides, is at the disposal of teachers who desire to instruct their own classes at the Garden. Arrangements must be made in advance so that such work will not conflict with other classes and lectures. For High School classes address *Curator of Public Instruction.* For Junior High and Elementary School classes address *Curator of Elementary Instruction.*

(*d*) The principal of any elementary or high school in Brooklyn may arrange also for a series of six lessons on plant culture to be given during the fall or spring to a class. These lessons will be worked out for the most part in the greenhouse. Such a course must be arranged for in advance, and the class must be accompanied by its teacher. Adapted for pupils above the fourth grade.

C. School and Home Gardening.—In order to encourage gardening in the school and at home, an annual Children's Garden Exhibit is held at the Garden in September. Prizes for excellence in various subjects are awarded to both schools and individuals. The privilege of competition at this exhibition is open to any school and also to any boy or girl in Brooklyn, even though the garden products exhibited may have been raised at his summer home. A *Leaflet* describing in detail the conditions for the exhibit and the prizes offered will be mailed on request.

The exhibit for 1924 will be held on *Friday* and *Saturday, September 26* and *27*. All exhibits, of schools as well as of individuals, must be brought to the Brooklyn Botanic Garden before 12 o'clock, *Friday, September 26.* The exhibit will be judged at 1 o'clock on that afternoon, and will be open for public schools at 2 p.m., Friday, when classes are invited to come with their teachers. The exhibit will be open to the general public on Friday afternoon

and on Saturday from 10 to 4. After 4 o'clock on Saturday afternoon the exhibitors may remove their exhibits. Prizes will be presented on Saturday afternoon, *October 11,* at 2:30 o'clock.

D. Seeds for School and Home Planting.—In order to assist the above work, packets of seeds are put up by the Botanic Garden for children's use. The price of the seeds is two cents a packet. In the early spring, lists of these seeds, conditions for entry as an exhibitor, and other information may be secured on application to the *Curator of Elementary Instruction.*

E. Conferences.—Conferences may be arranged by teachers and principals for the discussion of problems in connection with gardening and nature study. The last Monday afternoon of each month will be reserved for such conferences: appointments must be made in advance. Address Miss Ellen Eddy Shaw.

F. Study and Loan Material.—To the extent of its facilities, the Garden will provide, on request, various algae and protozoa, as well as living seedlings and leaves and twigs, or other plant parts for study. Where containers are necessary, as in the case of the algae and protozoa, they must be furnished by the school. Petri dishes will, on request, be filled with sterilized nutrient agar ready for use in the study of bacteria and molds. They should be delivered to the Garden, clean, and in general one week before the agar is desired. In all cases arrangements must be made by the teachers for calling for such material.

Teachers may also arrange to have various physiological experiments or demonstrations conducted at the Garden for the benefit of their classes. Communications in regard to these matters should be addressed to the *Curator of Public Instruction.*

G. Loan Sets of Lantern Slides.—Sets of lantern slides have been prepared for loan to the schools. Each set is accompanied by a short syllabus of explanatory nature. In all cases these sets must be called for by a special messenger and returned promptly in good condition. The subjects now available are as follows. Other sets are in preparation.

1. Plant Life
2. Spring Wild Flowers
3. Common Trees
4. Fall Wild Flowers
5. Forestry

II. PUBLIC LECTURES AND DOCENTRY

A. Lectures

Sundays at 3:30 p.m.

1. April 13. Scenic Wonders of the Northwest. Mr. LeRoy Jeffers, F.R.G.S.

2. April 27. The trees of Greater New York. Dr. Arthur Harmount Graves, Curator, Brooklyn Botanic Garden.

3. May 4. Motion Picture Presentation: The Children's Gardens of the Brooklyn Botanic Garden.

In the following series the lectures will be supplemented by a short trip in the Botanic Garden, conducted by the lecturer, for the purpose of seeing at first hand the plants discussed in the lecture.

4. May 18. Rock Gardens. Mr. Montague Free, Horticulturist, Brooklyn Botanic Garden. (*Lecture and Garden Demonstration.*)

5. May 25. Irises. Dr. George M. Reed, Curator, Brooklyn Botanic Garden. (*Lecture and Garden Demonstration.*)

6. September 21. Asters and other herbaceous perennials. Mr. H. E. Downer, Horticulturist, Vassar College. (*Lecture and Garden Demonstration.*)

7. September 28. Water-lilies. Mr. Charles L. Tricker, Horticulturist. (*Lecture and Garden Demonstration.*)

8. October 5. Cannas. Mr. Antoine Wintzer, Vice-President, Conard and Jones Co. (*Lecture and Garden Demonstration.*)

B. Docentry

To assist members and others in studying the collections the services of a docent may be obtained. This service is free of charge to members; to others there is a charge of 50 cents per person. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted.

III. COURSES OF INSTRUCTION

For the work in Children's Gardening and Nature Study the following equipment is available:

1. *The Children's Gardens,* on a piece of land about three-

quarters of an acre in extent, in the southern part of the Garden, divided into over 150 small plots which are used throughout the season for practical individual instruction in gardening.

2. *The Children's Building,* at the north end of this plot, containing rooms for consultation and for the storage of tools, seeds, notebooks, special collections, etc.

3. *The Children's Greenhouses,* three in number, for the use of juvenile as well as adult classes for instruction in plant propagation and related subjects.

4. Two large *Classrooms,* (in addition to the Boys' and Girls' Club Room (p. 20) in the Laboratory Building), equipped with stereoscopes and views, a stereopticon, plant collections, economic exhibits, models, and other apparatus and materials for instruction.

5. Three *Laboratory Rooms,* with the usual equipment for plant study.

6. The *Auditorium,* on the ground floor, capable of seating 570 persons, and equipped with a motion-picture lantern and stereopticon.

In addition to these accommodations, the dried plant specimens in the herbarium and the living plants in the conservatories and plantations are readily accessible, while the libraries, which contain a comprehensive collection of books on every phase of gardening and plant life, may be consulted freely at any time.

A. Children's Gardens: Nature Study

1. *Courses for Children*

The following courses are open to all boys and girls. Enrolment in these courses entitles the boy or girl to membership in the Boys' and Girls' Club of the Brooklyn Botanic Garden. This club, having an active membership of about 1,000, meets four times a year for discussion of subjects related to plant life. Papers on various botanical subjects are read at these meetings, and the speakers are then entitled to a silver pin, providing they have taken courses of study at the Garden extending over at least six months. For announcement concerning Children's Room see page 20.

A1. Preparation for the Outdoor Garden. — The following classes are open to boys and girls during the spring of each year.

The courses are planned for a better understanding of plant life and so that the outdoor garden may become a more intelligent piece of work. On account of limited space in the Children's Greenhouse, classes are limited to twenty. The fee for each course is *fifteen cents* to cover the cost of material.

Boys' Spring Course.—(*a*) *Saturday* mornings, 9–10:15, *February 9 to March 29.* (*b*) *Saturday* mornings, 10:30–11:30, *February 9 to March 29.*

Girls' Spring Course.—(*a*) *Saturday* mornings, 9–10:15, *February 9 to March 29.* (*b*) *Saturday* mornings, 10:30–11:30, *February 9 to March 29.* Miss Hammond, Miss Hickok.

A2. Advanced Work for Older Boys and Girls.—How to raise plants, mix soils, transplant, start seedlings for outdoor gardens, etc. Boys and girls who have taken spring courses under A4 are eligible for advanced work. The *fee* for the course is *twenty-five cents.* Each student may take home his plants and seedlings. This course is open to both boys and girls over twelve years of age. *Saturday* mornings at 9:30, *February 2 to March 29.* Miss Shaw.

A3. The Beginners' Garden.—Open annually to 50 boys and girls who have never had instruction in gardening at the Brooklyn Botanic Garden. This course takes up the subject of the small garden, what to plant, how to plant it, care, replanting, etc. *Application for plots should be made in person or in writing before March 1.* Size of plots 8 ft. by 10 ft. All crops belong to the individual. *Fee, twenty-five cents. Saturday* mornings, 9–12, *April 5 to October 4.* Miss Sanders.

A4. Second Year Gardens.—Open to 50 boys and girls who have had one or more seasons at the Brooklyn Botanic Garden—a continuation of Course A3. Registration should be made before September 1 of each year for the following year. *Fee, twenty-five cents. Saturday* mornings, 9–12. *April 5 to October 4.*

Miss Hickok.

A5. Junior Garden Assistants.—Open to older boys and girls, or to those who have mastered Courses A2 and A4. Size of plot 10 ft. by 20 ft. *Fee, fifty cents.* These gardens are for the raising of vegetables. The work is in the nature of a project, "How much can one raise on a plot 10 ft. by 20 ft.?" Hours to be

arranged. The student must put in at least two periods a week during the summer vacation, and, if possible, three. Registration date: *April 5.* Miss Hammond.

A6. Advanced Nature Work.—A course designed for those older boys and girls who have taken Courses A1–A5. Herbarium specimens will be prepared and the simpler principles of plant classification studied. Projects will be assigned to individuals. *Open only to pupil assistants of the Garden.* Hours to be arranged. Miss Shaw.

A7. Fall Greenhouse Work.—The following courses are self-explanatory and are for both beginners and advanced students:

Class A.—Open to boys and girls who have never taken any greenhouse work before. Bulbs used: narcissus, oxalis, primrose; also geranium cuttings. *Saturday* mornings at 9:15. *Fee, fifteen cents. October 11 to December 13.* Miss Hickok.

Class B.—Open to boys and girls over thirteen years of age. Subjects studied: hyacinth, Easter lily, calla lily, the botany of common cultivated plants, etc. *Fee, twenty-five cents. Saturday* mornings at 10, *October 11 to December 13.* Miss Hammond.

Class C.—Open to boys and girls who have been in at least two fall bulb classes before this. This class is for advanced work. The bulbs used will be hyacinth, tulip, narcissus, oxalis. Geranium cuttings and primroses will also be used. Time of class, 10:30, *Saturday* mornings. *Fee, fifteen cents. October 20 to December 1.* Miss Hammond.

Class D.—Open to any boy or girl. Subject: the making of garden Christmas presents. There will be a choice of gifts. Some of the articles made will be the following: a flower basket, seed packet, flower book-mark, painted pot and plant to go in it, flower calendar, wooden box with flower design, etc. *Saturday* mornings at 10:30. *Fee, twenty-five cents. October 11 to December 13.* Miss Hickok.

A8. Junior Gardeners' Course.—A course for boys 14–17 years of age. Lessons given in the care of border and other flower beds, in the weeding and care of small vegetable gardens, in mowing and watering lawns, repotting plants, etc. This is planned to fit boys for summer work and to enable them to obtain positions.

Hours to be arranged. *Fee, fifty cents.* Practical work with the gardeners and foreman, under the supervision of Miss Hammond. (*Not given in 1924.*)

A9. Nature Study for Boy Scouts, Girl Scouts, Camp Fire Girls, Scout Leaders, and Others.—Short courses of at least four periods each, with talks, demonstrations, and field trips in the grounds of the Botanic Garden and Prospect Park to study trees, shrubs, etc. The instruction and schedule dates will be adapted to meet the needs of the various groups that apply. *Open only to groups of at least ten persons.* Hours to be arranged.

Dr. Graves, Miss Hammond, and assistants.

A10. Special Work for High-School Pupils.—A course in gardening or greenhouse work adapted for high-school pupils. Classes to be arranged for by the high-school teacher. Miss Shaw.

2. Courses for Teachers

The following brief courses are designed primarily for teachers who wish to extend their knowledge of nature study and gardening for use in their school work, without taking the longer courses described under B, page 9. It should be noted that only the latter courses are accepted by the Board of Education for teachers' credits.

A21. Greenhouse Work for Teachers.—Do you wish to learn how to raise plants for the school garden or your own garden? This course is a practical one and almost the entire work is done in the greenhouses. All of the seedlings raised belong to the student. *Open to teachers only. A fee of $2* will be charged to cover cost of materials. Mondays in February, except the 18th, at 4 p.m. Miss Shaw, Miss Hickok.

A22. The School Garden.—A series of four practical lessons and demonstrations on the school garden; how to lay it off, plant it, kinds of seeds to use, school garden management, etc. *Fee, fifty cents,* to cover cost of materials. *Tuesdays,* 4 p.m., *March and April.* (Not offered in 1924.) Miss Shaw.

A23. Spring Nature Study for the Classroom.—This course of three lessons will acquaint the teacher with common nature-study material which may be taken into the classroom during the spring-

time. Demonstration materials will be given to members of this class. The work will be based on the syllabus of nature study for the schools of New York City, and will be entirely practical. *No fee will be charged* for this course. *Wednesdays,* 4 p.m., *May 14–28.*

Miss Hammond.

A24. Fall Garden Work.—Three lessons on home plants; window boxes; indoor planting of bulbs; the outdoor bulb bed. *Fee, one dollar. Mondays,* 4 p.m., *October 13–27.*

Miss Shaw, Miss Hickok.

A25. Fall Nature Study.—This course is a complement to the spring nature-study work and the material used will be the common material one would use in classroom work, showing seed dispersal, evergreens, deciduous trees, etc. Such subjects as Nature's preparation for winter will be covered. Three lessons. *No fee. Thursdays,* 4 p.m., *October 16–30.*

Miss Hammond.

A26. Advanced Agriculture.—A course of advanced work for those who have taken "Principles of Agriculture and Horticulture," B3. Fifteen weeks of practical work in the greenhouse. *Fee, eight dollars. Tuesdays,* 4 p.m., *beginning October 14.*

Miss Shaw.

B. Courses for Teachers of Children's Gardening and Nature Study

The courses for teachers in children's garden work are planned not only to prepare for garden work, but for the teaching of nature study as well. Our courses are so arranged that they emphasize not only the theory of each subject, but its actual practice, either in classroom, greenhouse, garden, or field. At the same time the work is correlated to meet the needs of each grade of the elementary school. There is an increasing demand for good nature-study work in our schools, and we make a special point of giving simple, definite, helpful work, grading it so that it applies directly to the immediate needs of our own city schools. Practice with classes of children of different ages is given in all this work.

The requirements for entrance are a certificate from a city training or normal school, a college diploma, or several years of certified successful teaching. These courses may be completed

during one year, or may be extended over a period of two or more years. The *fee for the entire course is thirty-five dollars,* payable in full at the time of registration, or course by course as they are covered. No money will be refunded if the student drops the work, and no monetary allowances will be made for courses taken at other institutions, although time allowances will be made.

Special stress is put upon the outdoor garden practice. This practice is of two kinds: (1) Practice with children. There are one hundred and fifty children in our outdoor garden, and every opportunity is given for practice in working with children and for the solving of problems connected with this phase of the work. (2) Practice in the teacher's garden. Each member of the class has a garden of her own and works it herself, thus performing all gardening operations to be taught later to children.

To those who satisfactorily complete this course a certificate will be given. *The five courses offered in children's gardening constitute one unit.* Open only to teachers.

These courses have been accepted by the Board of Education for teachers' credits as follows:

1. Any of the courses will be accepted toward meeting clause "b" of the conditions of eligibility for high-school license in Biology.

2. The course in Pedagogy of Botany and Educational Principles of Children's Gardening (B4) will be accepted as a satisfactory 30-hour course in Pedagogy toward meeting the requirement of 60 hours' work in Pedagogy in lieu of the written test in Principles and Methods of Teaching for Promotion License.

3. This course will be accepted as a pedagogical course, and either of the other four courses will be accepted as an academic course toward meeting the conditions of exemption from the academic paper in the examination for license as assistant to principal. Such exemption is granted to those who offer 120 hours of satisfactory work, 60 of which must be in the Science of Education and 60 in some branch of literature, science, or art, such 120 hours' work not being accomplished wholly within one academic year.

These courses have been accepted by the Brooklyn Teachers' Association and appear in its syllabus of courses.

The individual student may apply at any college for credits on these courses, which will be granted according to individual merit.

B1. General Botany.—Thirty sessions. A course designed to make clear the fundamental principles of morphological and physiological botany. With a view to correlation with the other courses described below, emphasis is laid upon the higher plants, particularly their classification and physiology, and in connection with the latter subject a consideration of plant diseases from a practical as well as theoretical viewpoint is also included. *Fee, $5. Thursdays,* 4 p.m., beginning *September 25.* Dr. Graves.

B2. Nature Study.—Thirty sessions. This course covers the plant material used in teaching nature study, and includes the identification of the common trees, shrubs, plants, wild flowers, and weeds. Mounts, charts, and diagrams are made. The student becomes familiar with the actual material. The course is entirely practical, work being done in both field and laboratory. Two hours of such work are weighted as one hour. *Fee, $5. Tuesdays,* 4 p.m., beginning *September 23.* Miss Hammond.

B3. Principles of Agriculture and Horticulture.—Thirty sessions. This course will be especially helpful to teachers. The principles of horticulture are considered and applied in a practical way through greenhouse, laboratory, and lecture work. The greenhouse work includes the following subjects: plant propagation by means of bulbs, rhizomes, roots, seeds, etc.; the care of the greenhouse; home plants; window-box materials; fertilizers. Insect and fungous pests, grafting and pruning are also included from both a practical and a theoretical point of view. *Fee, $7. Wednesdays,* 4 p.m., beginning *September 24.*

Miss Shaw and Mr. Free.

B4. Pedagogy of Botany and Educational Principles of Children's Gardening and Nature Study.—Thirty sessions. Discussion of the mental processes involved in learning and in teaching science and the fundamental principles which underlie and point the way to laboratory and field work. After this a course of study in gardening and nature study, based on the school syllabus, is worked out and the basic psychological and pedagogical principles discussed. This course includes all the modern phases of

the subject and is so arranged that it may be applied directly in classroom work. *Fee, $5. Thursdays,* 4 p.m., beginning *September 25.* (Offered in 1924, but *will not be given in 1925.*)

Dr. Gager and Miss Shaw.

B5. Garden Practice.—Thirty sessions. This course is entirely practical and includes all the outdoor work of the student in his own garden, applying the principles of agriculture and gardening, work with children in the garden, basketry and woodwork. Ninety hours is the minimum in this course, but students may profitably put in a greater number of hours to the maximum of 630 hours, or seven credits. *Fee, $5. For summer practice, fee $8. Tuesdays,* 4 p.m. (*Not given in 1924.*) Miss Shaw.

C. Courses for the General Public

The following courses are open to every one who has a general interest in plants. Teachers are welcome. They are *free to those enrolled as members of the Botanic Garden;** for others a small fee is required, as specified. Registration should be made with the instructor in person or by mail at least one week before the course opens, in order that adequate material, etc., may be provided. *No course will be given when less than six apply.*

1. *Spring Courses*

C1. Plants in the Home.—How to grow them. Five talks with demonstrations. Practice in potting, mixing soils, making cuttings, etc. This course deals with the principles to be followed in raising plants. The members of the class have the privilege of keeping the plants they have raised. *Fee, $2.50. Thursdays,* 4 p.m., *February 28 to March 27.* Mr. Free.

C3. The Flower Garden.—Making the most of it. Five lessons. How to improve soils and get results from planting; old-fashioned flowers; annuals; summer bedding; vines for screening unsightly objects; rose culture; growing of ornamental shrubs; pruning; how to make a lawn and keep it up. *Fee, $2.* (*Not given in 1924.*) Mr. Free.

* For information concerning the conditions of membership in the Brooklyn Botanic Garden consult the third page of the cover of this PROSPECTUS.

C7. The Story of Plant Evolution.—Four illustrated lectures: 1. The history of plant classification. 2. Plant evolution from algae to conifers. 3. The structure of flowers. 4. Families of flowering plants. *Fee, $1. Fridays,* 4 p.m., *February 29 to March 21.* Dr. Gundersen.

C8. Spring Flowers and Ferns.—Eight outdoor lessons in the Botanic Garden on the identification and classification of plants. The structure of flowers and the characters of plant families are studied. A hand lens is desirable. *Fee, $2.50. Fridays,* 4 p.m., *May 2 to June 20.* Dr. Gundersen.

C9. Trees and Shrubs of Brooklyn and Vicinity.—Ten outdoor lessons at the Garden and elsewhere in Greater New York, the principal object being to gain a ready acquaintance with the common trees and shrubs of the eastern United States, which are well represented in this region. The species are considered in systematic order, and the features pointed out by which they may be most easily recognized; also their habits, rate of growth, economic value and use, methods of planting and propagation; importance in forestry, horticulture, or landscape art. *Limited to 50 members enrolled in the order of application. Fee, $2.50. Saturdays,* 2:30 p.m., *April 5 to June 7.* Dr. Graves.

2. *Fall Courses*

C4. Gardening in the Fall.—Six lessons, with practical work in the greenhouse, on the methods of making cuttings, the various kinds of bulbs for fall planting, their treatment and care, the proper management of house plants and a discussion of the kinds suitable for cultivation. *On account of restricted space in the greenhouse, this class must be limited to 20. Registration according to the order of application. Fee, $2.50. Thursdays,* 4 p.m., *September 25 to October 30.* Mr. Free.

C5. Trees and Shrubs in their Winter Condition.—Eight outdoor lessons in the Botanic Garden and elsewhere in Greater New York on the characteristics of our common trees and shrubs, both native and cultivated, emphasizing their distinguishing features in the winter condition. *Fee, $2. Saturdays,* 2:30 p.m., *September 27 to November 15.* Dr. Graves.

C6. Fall Flowers and Fruits.—Six outdoor lessons, chiefly in the Botanic Garden. The distinguishing features of the more common kinds of native and cultivated fall flowers and fruits are studied, as well as the different types of fruits. *Fee, $1.50. Tuesdays,* 4 p.m., *September 23 to October 28.* Dr. Gundersen.

D. Course for the Training of Gardeners

The following course for the training of gardeners is planned to meet the needs of students of the Federal Board for Vocational Education, but is open to all who meet the necessary requirements.

Requirements:

Age.—At least 18.

Personality.—To be satisfactory to Botanic Garden authorities.

Education.—Schooling through at least the first two years of high school, or its equivalent in experience and general intelligence, to be decided by personal conference.

Enrolment.—Students may, for the present, enter the course at any time.

Continuation.—Students who give evidence that they are not likely to succeed in gardening will not be allowed to continue the course.

Vacations.—Four weeks distributed throughout the year.

First Year

First Quarter

1. Garden and Greenhouse Practice.—Five days a week; hours 9–12, 1–2:30.

Care of tools, care of cold frames, making a hotbed, seed sowing, transplanting, lawn making, hoeing and cultivating, spraying for insect and fungous pests, watering, winter protection of plants, manuring, harvesting and storing, staking and tying, supports for climbing plants, pruning, and repair of trees, propagation by seeds, cuttings, layers, budding and grafting; care of rock garden, perennial garden, bedding plants, aquatic garden, wild garden; making up window boxes and hanging baskets; transplanting trees and shrubs, etc.

Greenhouse.—Watering, ventilating, shading, cleaning plants of insect pests, potting, heating, practice with special crops, orchids (planting and general care); chrysanthemums (potting and general care); ferns, palms, *Primula, Cyclamen,* etc.

2a. Elementary Botany.—Plant structure and function. Twice a week.

3. Soils and Fertilizers.—Once a week.

4. Inspection of the Plantations and Plant Houses Under Guidance.—Study of plant materials. Once a week.

5. Special Lectures and Conferences.—Saturdays.

6. Assigned Readings and Reports.—Once a week.

Second Quarter

1. Garden and Greenhouse Practice (continued).

2a. Elementary Botany.—Plant structure and function (continued). Once a week.

4. Inspection of the Plantations and Plant Houses Under Guidance (continued).—Once a week.

5. Special Lectures and Conferences.—Saturdays.

6. Assigned Readings and Reports.—Once a week.

7a. Animal Friends and Foes in the Garden.—Once a week.

8a. Fungous Diseases of Plants.—Once a week.

Third Quarter

1. Garden and Greenhouse Practice (continued).

2b. Elementary Botany.—Classification, identification of plants. Once a week.

4. Inspection of the Plantations and Plant Houses Under Guidance (continued).—Once a week.

5. Special Lectures and Conferences.—Saturdays.

6. Assigned Readings and Reports.—Once a week.

9. Principles of Horticulture.—Once a week.

10. Trips to Nurseries, Private Places and Other Gardens Under Guidance.—Once a month.

11. Plant Relations.—Once a week for six weeks.

Fourth Quarter

1. Garden and Greenhouse Practice (continued).

2b. Elementary Botany.—Classification, identification of plants (continued). Once a week.

4. Inspection of the Plantations and Plant Houses Under Guidance (continued).—Once a week.

5. Special Lectures and Conferences.—Saturdays.

6. Assigned Readings and Reports.—Once a week.

9. Principles of Horticulture.—Once a week.

10. Trips to Nurseries, Private Places and Other Gardens Under Guidance.—Once a month.

12. Garden Carpentry.—Once a week.

Second Year

First Quarter

1. Garden and Greenhouse Practice (continued).

4. Inspection of the Plantations and Plant Houses Under Guidance (continued).—Once a month.

5. Special Lectures and Conferences.—Saturdays.

6. Assigned Readings and Reports.—Once a week.

10. Trips to Horticultural Exhibits, Nurseries, Private Places and Other Gardens Under Guidance.—Once a month.

13. Garden Planning.—Once a week.

14. Floriculture.—Once a week.

15. Vegetable Growing.—Once a week.

16. Floral Decoration.—Once a month.

Second Quarter

1. Garden and Greenhouse Practice (continued).

4. Inspection of the Plantations and Plant Houses Under Guidance (continued).—Once a month.

5. Special Lectures and Conferences.—Saturdays.

6. Assigned Readings and Reports.—Once a week.

8b. Fungous Diseases of Plants.—Advanced course. Once a week for six weeks.

10. Trips to Horticultural Exhibits, Nurseries, Private Places and Other Gardens Under Guidance.—Once a month.

14. Floriculture (continued).—Once a week.
15. Vegetable Growing (continued).—Once a week.
16. Floral Decoration.—Once a month.
17. Plant Breeding.—Once a week for six weeks.

Third Quarter

1. Garden and Greenhouse Practice (continued).
4. Inspection of the Plantations and Plant Houses Under Guidance (continued).—Once a month.
5. Special Lectures and Conferences.—Saturdays.
6. Assigned Readings and Reports.—Once a week.
7b. Animal Friends and Foes in the Garden. — Advanced course. Once a week for six weeks.
10. Trips to Horticultural Exhibits, Nurseries, Private Places and Other Gardens Under Guidance.—Once a month.
14. Floriculture (continued).—Once a week.
16. Floral Decoration.—Once a month.
18. Types of Gardens.—Once a week.
19. Road and Walk Making; Use of Cement in Garden Structures.

Fourth Quarter

1. Garden and Greenhouse Practice (continued).
4. Inspection of the Plantations and Plant Houses Under Guidance (continued).—Once a month.
5. Special Lectures and Conferences.—Saturdays.
6. Assigned Readings and Reports.—Once a week.
10. Trips to Horticultural Exhibits, Nurseries, Private Places and Other Gardens Under Guidance.—Once a month.
16. Floral Decoration (continued).—Once a month.
20. Window Boxes, Hanging Baskets, Wardian Cases, etc.—Once a week for six weeks.
21. Greenhouse Construction.—Once a week for six weeks.
22. Plant Forcing.—Once a week.
Principles of Pruning.—Once a week for six weeks.

CERTIFICATION

For final certification one year's satisfactory experience will be required, under direction, in an accepted commercial or private garden.

E. Consultation and Independent Investigation

1. *Consultation*

Consultation and advice, and the facilities of the laboratories, library, and herbarium are freely at the service of members of the Botanic Garden and others with special problems relating to plants or plant products, especially in the following subjects:

1. **Plant diseases** (phytopathology) and classification of fungi (mycology). Dr. Reed.

2. **Plant breeding** and allied subjects (genetics and experimental evolution). Dr. White.

3. **Plant geography** (phytogeography) **and ecology.** Mr. Taylor.

4. **Classification and identification of flowering plants** (systematic botany). Dr. Gundersen.

5. **The growing of cultivated plants** and their arrangement; also their adaptation to soils, climate, and other factors (horticulture and gardening). Mr. Free.

2. *Investigation* *

For the following research courses, open to those properly qualified for independent investigation, there is a charge covering all expenses, including laboratory fee, of *$30 for each full course* of 100 credit hours, and *$20 for each half course* of 50 credit hours.

E6. Research in Mycology and Plant Pathology.—Independent investigation of problems relating to fungi and fungous diseases of plants. Dr. Reed.

E7. Research in Plant Genetics.—Independent investigation of problems of variation and heredity, including that phase of cytology having a direct bearing on the subject matter of genetics. Dr. White.

E8. Research in Forest Pathology.—Independent investigation of the diseases of woody plants. Dr. Graves.

* Courses of graduate rank offered by the Botanic Garden, when approved by the Faculty of the Graduate School of New York University, are listed as courses in the Graduate School, and are given the same credit as other graduate courses. Properly qualified students who take these courses may present them in satisfaction of the requirements for advanced degrees given by the University. Graduate credit has also been allowed elsewhere for such advanced work done at the Garden.

E9. Research in Systematic Botany of the Flowering Plants.
Dr. Gundersen.

IV. OTHER EDUCATIONAL FEATURES

Plantations

The plantations comprise several sections, as follows:

1. The Local Flora (native wild flower garden).
2. General Systematic Section (trees, shrubs, and herbaceous plants not native within 100 miles of Brooklyn).
3. Ecological Garden.
4. Rock Garden.
5. Children's Garden.
6. Japanese Garden, etc.

As noted under *Docentry* (p. 4), arrangements may be made for viewing the plantations under guidance. They are open free to the public daily from 8 a.m. until dark; on Sundays and holidays from 10 a.m. until dark.

Conservatories

The Garden conservatories contain a collection of tender and tropical plants. Of special interest for teachers of nature study and geography are the following useful plants from the tropics and subtropics: banana, orange, lemon, lime, kumquat, tamarind, West Indian cedar (the source of the wood used for cigar boxes), eucalyptus, Manila hemp, sisal, pandanus (source of the fiber used for making certain kinds of fiber hats), fig, grape vines from north and south Africa, date palm, cocoanut palm, chocolate tree, coffee, tea, ginger, bamboo, mahogany, balsa, cocaine plant, black pepper, cardamom, olive, pomegranate, logwood, durian, mango, sugar cane, avocado (so-called "alligator pear"), West Indian and other rubber plants, banyan, religious fig of India, and numerous others.

The Conservatories are open April 1 to November 1, 10 a.m.–4:30 p.m. (Sundays, 2–4:30); November 1 to April 1, 10 a.m.–4 p.m. (Sundays, 2–4).

Herbarium

The Garden herbarium consists at present of over 184,000 specimens, including phanerogams, ferns, mosses, liverworts, lichens, parasitic and other fungi, algae, and myxomycetes. This collection may be consulted from 9 a.m. until 5 p.m. by those interested, and specimens submitted will be gladly identified.

Library

The rapidly growing library of the Garden comprises at present over 9,500 volumes and over 6,500 pamphlets. This is not a circulating library, but is open free for consultation to all persons from 9 a.m. until 5 p.m. (Saturdays, 9 to 12). Over 675 periodicals and serial publications devoted to botany and closely related subjects are regularly received.

Children's Room

A gift of $1,500 in 1921 from the late Mrs. George D. Pratt, supplemented in 1923 by a further gift of $500 from Mr. George D. Pratt, has made it possible to provide a beautifully decorated room for the use of the Boys' and Girls' Club. Any boy or girl who is enrolled, or has been enrolled, in any of the children's classes at the Garden is eligible for membership in this club, which now numbers about 1,000 active members. The room contains shelves for a nature-study library, of which a nucleus has already been secured, and is equipped with stereoscopic views, photographs, and preserved and living specimens of plant life, for the instruction and entertainment of boys and girls. The room is open free to all children. Contributions of specimens and of books on nature study and closely related subjects will be most welcome.

BULB PLANTING, 1923

Over 50,000 bulbs were planted in the Garden during 1923. The greater part, about 40,000, were distributed in grassy areas in various parts of the Garden to give a naturalistic effect.

Five thousand Narcissus "Emperor" were used to extend the planting of this variety on the knoll southwest of the Laboratory Building. Ten thousand Poet's Narcissus of an early blooming kind (*Narcissus poeticus ornatus*) were planted on the border mound, among the collection of young nut trees, west of the "White Oak" circle.

The Crocuses on the border mound opposite the Oleaceae have given visitors great pleasure during their blooming season in early spring during the past two years. This planting has been greatly extended by the addition of fifteen thousand crocus in the colors white, striped blue, and yellow.

The Winter Aconite, *Eranthis hyemalis,* is one of the earliest of the spring "bulbs" to bloom. It is not really a bulb, although usually classed as such in seedmen's catalogs, but has a tuberous rootstock. Three thousand of these dainty, buttercup-like flowers have been planted under the willows by the boulder bridge and should make a charming display next spring.

Because of the relaxation, for a period, of the stringent regulations of the Federal Horticultural Board, prohibiting the importation of many plants, we have been enabled to make a trial planting of the seldom seen (in this country) Guinea Hen Flower, *Fritillaria Meleagris.* A thousand of these delightful bulbs are planted in the grass north of the birch collection.

The Feathered Hyacinth, *Muscari comosum* var. *monstrosum,* a form of Grape Hyacinth in which all the flowers are sterile, has been planted to the number of one thousand on the bank north of the Magnolia triangle.

Those who have seen the wonderful display made by the bluebells naturalized under the trees in the Queen's Cottage grounds of the Royal Botanic Gardens, Kew, will be interested to know that the Brooklyn Botanic Garden has initiated, on a small scale, a similar effect by planting five thousand *Scilla nutans major* on the border mound north and south of the rock garden.

Two thousand Snowdrop bulbs, *Galanthus Elwesii,* have also been planted under the oak trees immediately south of the barberry collection.

A large number of bulbs have been added to those already at home in the rock garden, including one thousand Crocuses, both autumn and spring flowering; five hundred Glory of the Snow, *Chionodoxa Luciliae;* five hundred Grape Hyacinth, *Muscari botryoides;* and five hundred Siberian Squill, *Scilla sibirica.*

Although not "showy," in the ordinary sense, the bed of Summer Hyacinths (*Galtonia candicans*), in the Monocotyledon section, containing about six hundred bulbs planted last spring, created great interest. These bulbs were removed this fall to make room for a collection of tulips—one thousand bulbs in forty species and varieties. These in turn will be lifted next spring, after blooming, to make room for *Galtonia* to provide a summer display. The near-by Amaryllidaceae bed has been planted with approximately six hundred Narcissus in twenty-four species and varieties. The idea in this and the tulip bed is to represent so far as possible the various types of flowers found in these genera.

A list of bulbs in tabular form follows:

Chionodoxa Luciliae	500	
Crocus	16,000	in 5 varieties
Eranthis hyemalis	3,000	
Fritillaria meleagris	1,000	
Galanthus Elwesii	2,000	
Galtonia candicans	600	
Muscari	1,500	in 2 varieties
Narcissus	15,825	in 28 varieties
Scilla	5,500	in 3 varieties
Tulip	1,000	in 40 varieties
	46,925	

MONTAGUE FREE.

AWARD OF PRIZES FOR BOOK PLATE DESIGN

On Tuesday afternoon, December 11, 1923, prizes were distributed to the successful competitors for a design for a book plate to be used in the books of the special library in the Boys' and Girls' Club Room in the Laboratory building.

The competition was open to the students in the art departments of all Brooklyn High Schools, but each school was limited to three designs—one from each of three contestants, to be chosen from those submitted. The regulations required that the drawing and design should be the exclusive work of the pupil submitting it, that it should measure 5.5 x 8.5 inches, that it should be done in pen and ink, should be typical of a child's interest in plant life, should include the words "Brooklyn Botanic Garden, Boys' and Girls' Club," and should have a panel with the words "Presented by," and a space to contain a donor's name. The Garden reserved the right to reject all designs if not deemed worthy of the prize.

Altogether, 26 designs were submitted, showing marked originality and beauty. The judges met on Friday afternoon, November 16, and awards were made as follows:

First prize, $15, Edna Snyder—Bay Ridge High School
Second prize, $10, Charles Geier—Commercial High School
Third prize, $5, Virginia Bowman—Erasmus Hall High School
Third prize, $5, B. A. Ginsburg—Commercial High School
1st Honorable mention, Edna Miller—Bay Ridge High School
2d Honorable mention, M. L. Berg—Erasmus Hall High School

All contestants were given a silver pin bearing the seal of the Brooklyn Botanic Garden.

The judges were Mr. William H. Fox, Director of the Brooklyn Museum, Chairman; Mr. J. Thomson Willing, President of the American Institute of Graphic Arts and editor of the Gravure Service Corporation; and Miss Florence A. Newcomb, of the Art Department of the Washington Irving High School.

The prizes were presented by Dr. C. S. Gager, director of the Garden, and tea was served by the Department of Elementary Instruction, Miss Newcomb pouring. Invited guests included the contestants and their teachers, and the members of the Woman's Auxiliary of the Botanic Garden.

The Brooklyn Institute of Arts and Sciences

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GENERAL INFORMATION

Membership.—All persons who are interested in the objects and maintenance of the Brooklyn Botanic Garden are eligible to membership. Members enjoy special privileges. Annual Membership, $10 yearly; Sustaining Membership, $25 yearly; Life Membership, $500. Full information concerning membership may be had by addressing *The Director, Brooklyn Botanic Garden, Brooklyn, N. Y.* Telephone, 6173 Prospect.

The Botanic Garden is open free to the public daily from 8 a.m. until dark; on Sundays and Holidays open at 10 a.m.

Entrances.—On Flatbush Avenue, near Empire Boulevard (Malbone Street), and near Mt. Prospect Reservoir; on Washington Avenue, south of Eastern Parkway and near Empire Boulevard; on Eastern Parkway, west of the Museum Building.

The street entrance to the Laboratory Building is at 978 Washington Avenue, opposite Montgomery Street.

To Assist Members and others in studying the collections the services of a docent may be obtained. This service is free of charge to *members of the Botanic Garden;* to others there is a charge of 50 cents per person. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted.

To Reach the Garden take Broadway (B.M.T.) Subway to Prospect Park station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

PUBLICATIONS
OF THE
BROOKLYN BOTANIC GARDEN

RECORD. Established, January, 1912. An administrative periodical issued quarterly. Contains, among other things, the *Annual Report* of the director and heads of departments, special reports, announcements of courses of instruction, miscellaneous papers, and notes concerning Garden progress and events. Free to members of the Garden. To others one dollar a year; 25 cents a copy.

MEMOIRS. Established, July, 1918. Published irregularly.

Volume I, *Dedication Papers:* comprising scientific papers presented at the dedication of the laboratory building and plant houses, April 19–21, 1917. Price $3.50, plus postage.

Volume II. The vegetation of Long Island. Part I, The vegetation of Montauk: A study of grassland and forest. Price $1.00, plus postage.

CONTRIBUTIONS. Papers originally published in botanical or other periodicals, reissued as "separates," without change of paging, and numbered consecutively. This series includes occasional papers, as well as those embodying the results of research done at the Garden, or by members of its staff or students. Twenty-five numbers constitute one volume. Price 25 cents each, $5.00 a volume.

VOLUME II

26. *Plant composition and soil acidity of a Maine bog.* 4 pages, 1921.

27. *The origin of new varieties of Nephrolepis by orthogenetic saltation. II. Regressive variation or reversion from the primary and secondary sports of Bostoniensis.* 18 pages, 6 plates. 1922.

28. *Botanical exploration in Bolivia.* 13 pages. 1922.

29. *Anthracnose of the Boston fern.* 7 pages, 2 plates. 1923.

30. *Varietal resistance and susceptibility of Sorghums to Sphacelotheca Sorghi (Link) Clinton and Sphacelotheca Cruenti (Kühn) Potter.* 12 pages, 2 plates. 1923.

31. *The Melanconis disease of the butternut (Juglans cinerea L.).* 23 pages, 2 plates, 5 figs. 1923.

32. *New bud sports of Nephrolepis.* 21 pages, 2 plates, 4 figures. 1923.

LEAFLETS. Established, April 10, 1913. Published weekly or biweekly during April, May, June, September, and October. The purpose of the *Leaflets* is primarily to give announcements concerning flowering and other plant activities to be seen in the Garden near the date of issue, and to give popular, elementary information about plant life for teachers and others. Free to members of the Garden. To others, fifty cents a series. Single numbers 5 cents each.

GUIDES to the collections, buildings, and grounds. Price based upon cost of publication.

SEED LIST. Issued in December of each year.

AMERICAN JOURNAL OF BOTANY. Established, January, 1914. Published, in coöperation with the BOTANICAL SOCIETY OF AMERICA, monthly, except during August and September. Subscription, $6.00 a year.

ECOLOGY. Established, January, 1920. Published quarterly in coöperation with the ECOLOGICAL SOCIETY OF AMERICA. Subscription, $4.00 a year.

GENETICS. Established, January, 1916. Bi-monthly. Subscription, $6.00 a year.

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BROOKLYN BOTANIC GARDEN RECORD

VOL. XIII APRIL, 1924 NO. 2

THIRTEENTH ANNUAL REPORT

OF THE

BROOKLYN BOTANIC GARDEN

1923

"The employment most honorable and most profitable to the people is to labor for the diffusion and extension of the ideas of men." *Napoleon Bonaparte.*

"Nothing is more important for the progress of civilization in the United States than the generous, hearty, and unhampered devotion of thinkers and investigators to the cultivation, advance, and dissemination of science."
J. G. Schurman.

"The multiplication of objects of beauty in our cities—parks, and all that usually goes with them—is not extravagance. The effect of these things, acting gradually and exerted unconsciously upon the citizens, produces in time results which no one can measure, but of the value of which there cannot be the slightest doubt." *R. H. Wolcott.*

FOR THE ADVANCEMENT OF BOTANY
AND THE SERVICE OF THE CITY

PUBLISHED QUARTERLY

AT LANCASTER, PA.

BY THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

BROOKLYN, N. Y.

Entered as second-class matter in the postoffice at Lancaster, Pa., under act of August 24, 1912.

BOTANIC GARDEN STAFF

DR. C. STUART GAGER, *Director*

MR. NORMAN TAYLOR, *Curator of Plants and Plantations*

DR. O. E. WHITE, *Curator of Plant Breeding and Economic Plants*

DR. GEORGE M. REED, *Curator of Plant Pathology*

DR. ARTHUR HARMOUNT GRAVES, *Curator of Public Instruction*

MISS ELLEN EDDY SHAW, *Curator of Elementary Instruction*

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DR. RALPH CURTISS BENEDICT, *Resident Investigator*

MR. HAROLD A. CAPARN, *Consulting Landscape Architect*

MISS MARY AVERILL, *Honorary Curator of Japanese Gardening and Floral Art*

MR. MONTAGUE FREE, *Horticulturist and Head Gardener*

MISS PHILURA H. BROWER, *Secretary*

MR. FRANK STOLL, *Registrar and Custodian of Buildings*

MR. LOUIS BUHLE, *Photographer*

MR. HERMAN KOLSH, *Foreman*

HIGH POINTS

1. The attendance of adults and children at all classes and lectures was nearly 100,000.

2. 775 classes with an enrollment of over 53,000 came to the Garden with their teachers for lectures, classes, and demonstrations.

3. Over 46 per cent. of the Public Schools sent classes to the Garden during the year. Many schools are too far away to permit of this.

4. Over 90 per cent. of the Public Elementary Schools, and 100 per cent. of the High Schools made use of the educational cooperation afforded by the Garden.

5. Over 390 public school teachers sought conferences with members of the Garden Staff concerning problems in connection with their classes which have a total enrollment of 146,000 pupils.

6. Nearly 4,000 adults and children were enrolled in Botanic Garden classes during the year.

7. Over 400 requests for information concerning plant life were received from the general public in 1923.

8. Over 1,800 teachers have been supplied with study material for their classes, and nearly 5,000 potted plants have been placed in school rooms.

9. Over 91,400 children have been supplied with seeds for planting in school and home gardens.

10. The Botanic Garden has taken the initiative in the movement to secure legislation for the protection of native wild flowers and ferns in New York State.

11. The Garden Library, open free to the public daily for reference, has on file over 700 periodical publications on plant life. There are over 9,800 books and over 6,600 pamphlets.

12. The plantations and grounds, of increasing beauty and educational value, were visited by over 408,000 persons.

13. Demands upon the Garden have increased in connection with every activity, educational, scientific, recreational, but financial support has steadily decreased since 1921.

14. Membership in the Garden affords an opportunity for everyone to cooperate in its great work.

15. Additional endowment is urgently needed—now.

PRIVILEGES OF MEMBERSHIP

1. Free admission to the buildings and grounds at all times.
2. Cards of admission for self and friends to all exhibitions and openings preceding the admission of the general public, and to receptions.
3. Services of docent (by appointment), for self and party, when visiting the Garden.
4. Admission of member and his or her immediate family to all lectures and classes under Garden auspices, at the Garden or elsewhere.
5. Special lectures and classes for the children of members.
6. Copies of Garden publications, as follows:

    a. Record
    b. Guides
    c. Leaflets
    d. Contributions

7. Privileges of the Library and Herbarium.
8. Expert advice on the choice and care of plants, indoors and out, on planting the home grounds, the care of lawns, and the treatment of plants affected by insect and fungous pests.
9. Identification of botanical specimens.
10. Admission to all field trips, and other scientific meetings under Garden auspices.

INFORMATION CONCERNING MEMBERSHIP

The Brooklyn Institute of Arts and Sciences is organized in three main departments: 1. The Department of Education. 2. The Museums. 3. The Botanic Garden.

Any of the following seven classes of membership may be taken out through the Botanic Garden:

1. Annual member	$ 10
2. Sustaining member	25
3. Life member	500
4. Permanent member	2,500
5. Donor	10,000
6. Patron	25,000
7. Benefactor	100,000

Sustaining members are annual members with full privileges in Departments one to three. Membership in classes two to seven carries full privileges in Departments one to three.

In addition to opportunities afforded to members of the Botanic Garden for public service through cooperating in its development, and helping to further its aims to advance and diffuse a knowledge and love of plants, to help preserve our native wild flowers, and to afford additional and much needed educational advantages in Brooklyn and Greater New York, members may also enjoy the privileges indicated on the preceding page.

Further information concerning membership may be had by addressing The Director, Brooklyn Botanic Garden, Brooklyn, N. Y., or by personal conference by appointment. Telephone, 6173 Prospect.

THE BOTANIC GARDEN AND THE CITY

THE BROOKLYN BOTANIC GARDEN, established in 1910, is a Department of the Brooklyn Institute of Arts and Sciences. It is supported in part by municipal appropriations, and in part by private funds, including income from endowment, membership dues, and special contributions. Its articulation with the City is through the Department of Parks.

The City owns the land devoted to Garden purposes, builds, lights, and heats the buildings, and keeps them in repair, and includes in its annual tax budget an appropriation for other items of maintenance. One third of the cost of the present buildings (about $300,000) was met from private funds.

Appointments to all positions are made by the director of the Garden, with the approval of the Botanic Garden Governing Committee, and all authorized expenditures for maintenance are made in the name of the private organization, from funds advanced by the Institute, which, in turn, is reimbursed from time to time by the City, within the limits, and according to the terms, of the annual appropriation.

All plants have been purchased with private funds since the Garden was established. In addition to this, it has been the practice of the Garden to purchase all books for the library, all specimens for the herbarium, all lantern slides, and numerous other items, and to pay certain salaries, with private funds.

The urgent needs of the Garden for private funds for all purposes are more than twice as great as the present income from endowment, membership dues, and special contributions. The director of the Garden will be glad to give full information as to possible uses of such funds to any who may be interested.*

* A written *Agreement,* dated August 17, 1914, between the City of New York and the Institute, touching the Botanic Garden, published in full in the *Brooklyn Botanic Garden Record,* for April, 1915, amends the agreement of September 9, 1912, which amends the original agreement of September 28, 1909, published in the *Record* for January, 1912.

FORMS OF BEQUEST TO THE BROOKLYN BOTANIC GARDEN

Form of Bequest for General Purposes

I hereby give, devise, and bequeath to The Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y., the sum of.....Dollars, the income from which said sum to be used for the educational and scientific work of the Brooklyn Botanic Garden.

Form of Bequest for a Curatorship

I hereby give, devise, and bequeath to The Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y., the sum of .....Dollars, as an endowment for a curatorship in the Brooklyn Botanic Garden, the income from which sum is to be used each year towards the payment of the salary of a curator in said Botanic Garden, to be known as the (here may be inserted the name of the donor or other person) curatorship.

Form of Bequest for a Fellowship

I hereby give, devise, and bequeath to The Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y., the sum of.....Dollars, the income from which sum is to be used in the payment of a fellowship for advanced botanical investigation in the Brooklyn Botanic Garden, to be known as the .....fellowship.

Form of Bequest for other particular purposes designated by the testator

I hereby give, devise, and bequeath to The Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y., the sum of.....Dollars, to be used (or the income from which to be used) for the Brooklyn Botanic Garden *

.....

.....

* The following additional purposes are suggested for which endowment is needed.

1. Botanical research.
2. Publishing the results of botanical investigations.
3. Popular botanical publication.
4. The endowment of a lectureship, or a lecture course.
5. Botanical illustration for publications and lectures.
6. The purchase and collecting of plants.
7. The beautifying of the grounds.
8. The purchase of publications for the library.
9. Extending and enriching our work of public education.

THIRTEENTH ANNUAL REPORT

OF THE

BROOKLYN BOTANIC GARDEN

1923

FIG. 1. A corner in the Japanese Garden, showing Inari Shrine, wooden lanterns, and artist sketching. The botanic garden is being more and more frequented by artists.

BROOKLYN
BOTANIC GARDEN
RECORD

VOL. XIII APRIL, 1924 NO. 2

THIRTEENTH ANNUAL REPORT OF THE BROOKLYN BOTANIC GARDEN, 1923

REPORT OF THE DIRECTOR

TO THE GOVERNING COMMITTEE OF THE BOTANIC GARDEN:

I have the honor to present herewith the Thirteenth Annual Report of the Brooklyn Botanic Garden, for the calendar year 1923.

Investigations

> *". . . for the advancement of botanical science and knowledge, and the prosecution of original researches therein and in kindred subjects."* [1]

With the sole exception of maintaining a collection of living plants, botanical research is the primary object of the Brooklyn Botanic Garden, as specified in the Act of the Legislature of New York State, above quoted, authorizing the establishment of the Garden. In the Agreement of 1914 between the City of New York and the Brooklyn Institute of Arts and Sciences concerning the establishment of the Garden, botanical research is made not only permissive but obligatory, for paragraph sixteen of the Agreement states that the director (there called the Chief botanist) and other members of staff "*shall make botanic researches . . . and that they shall labor to the best of their ability for the advancement of botanical science.*" If botanical research were neglected or made of secondary importance the Botanic Garden would fail to carry out one of the main purposes for which it was es-

[1] Laws of New York, 1911, Chapt. 178. An act providing for the establishment of the *Brooklyn Botanic Garden.*

tablished and would also fail to fulfill the terms of its *Agreement* with the City; furthermore, it would fail to measure up to its largest opportunities and obligations as a botanic garden—fail to render, in character and extent, the service to the community, to science, and to humanity which every such institution ought to render. Nothing could be more disastrous to the best interests of the Garden than failure to recognize the vital importance of research and our clear obligation to carry it on.

I am pleased to submit the following brief summaries of the investigations under way during 1923.

The subject of the diseases of trees is particularly important for a municipality like New York owning thousands of acres of forest. The public parks of Greater New York have a total of 8,196 acres, of which 1,320 acres are in Brooklyn. Of 50 miles of tree-shaded parkways in the Greater City, 30 miles are in Brooklyn. Most of the drinking water of New York City falls as rain on the Ashokan watershed. This watershed has an area of 15,000 acres, about one-half of which is wooded. The city has planted there over two million trees, including more than one million pines of several species.

In view of these facts it will be recognized that no state or county has more reason to be vitally interested in the question of tree diseases than has New York City. The importance of this is further emphasized when we recall that, since the chestnut tree disease was first discovered in 1904 in the New York Zoological Park, the City has lost tens of thousands of trees having a monetary value of several million dollars. In Brooklyn alone as many as 17,000 chestnut trees have been destroyed by this disease, and it is now no longer possible to grow chestnut trees in the City parks.

Many of the million or more pines planted at great expense on the Ashokan watershed are threatened with death from the white pine blister rust disease now rapidly spreading throughout the eastern United States.

The City has not only a financial and selfish interest in this situation, but should also recognize some obligation to the country at large. If the nature of the chestnut tree disease and its control

had been understood in 1904, the City would not only have been spared the loss of the trees and the financial loss thereby entailed, but the disease might have been brought under control here and its spread to surrounding territory prevented or controlled.

To be sure, tree diseases are not as vital a matter as human diseases, but there is every reason why the City should generously support investigations into the nature and control of plant diseases just as it maintains a department of health. It should not depend upon outside agencies and organizations in one case any more than in the other.

It is particularly fitting for an institution like the Brooklyn Botanic Garden to prosecute studies along such fundamental lines as disease resistance in plants—work not adequately provided for elsewhere—as well as along lines of immediate concern, like the diseases of trees in streets, parks, and watersheds. Work along these lines is reported in the following paragraphs.

Diseases of Trees

Chestnut Disease.—Acting as collaborator in the Office of Investigation in Forest Pathology, Bureau of Plant Industry, U. S. Department of Agriculture, Dr. Graves has extended the study of disease-resistant chestnuts which he located in the vicinity of New York in 1918. About two dozen two-year-old seedlings, offspring of these New York trees, are now growing in the experimental plot of the Garden, from which it is hoped to determine whether the parental character of resistance is inherited. Experiments in crossing this native New York stock with the resistant Japanese and Chinese species are under way.

Butternut Disease.—Dr. Graves has finished his investigations of the disease which is seriously affecting our butternut trees. In October his paper "The Melanconis Disease of the Butternut" appeared in the journal, *Phytopathology,* summarizing the results of his work, which covered a period of four years. The Japanese Walnut, a close relative of the native butternut, is also extremely susceptible. Dr. Graves has worked out the life history of the causal fungus, having linked together two stages of its development, formerly thought to be distinct fungi, and has

demonstrated its pathogenicity by several series of experiments. He recommends various remedial and preventive measures, and urges the need of study of the relations of this parasite to species allied to the Butternut, such as the Black Walnut and English Walnut.

Birch Canker.—Work begun in 1918 on the *Nectria* canker of the birch has been continued by Dr. Graves during the past summer. He has found this disease, which is very destructive in this region on the Cherry Birch (*Betula lenta*), on the Yellow Birch (*Betula lutea*), and the Paper Birch (*Betula papyrifera*) in Maine. Inoculation experiments on the latter species in Maine are now in progress.

Disease Resistance

Disease Resistance.—The utilization of disease-resistant varieties of plants has long been a recognized method of plant disease control. Plant growers are familiar with the fact that certain varieties are able to withstand the attacks of parasites which prove to be very serious to other varieties. The discovery and cultivation of varieties which show a clearly defined resistance to a particular disease is an obvious way to avoid loss. In the long run the use of disease-resistant types is the most effective method of disease control.

The problem of developing suitable resistant varieties is a very complicated one. For its solution, there is involved an intimate knowledge of the relations between the host and the parasite. In view of the fact that many parasitic fungi are highly specialized to particular hosts, a further problem in the development of resistant varieties arises. Progress in breeding disease-resistant varieties requires that the resistance or susceptibility towards the various races of the parasite be fully determined. To do this the importance of environmental conditions in the appearance and spread of a disease must be fully recognized, in order to avoid mistaking resistance for mere chance escape from a disease.

It also is highly important that a complete study of the inheritance of the disease-resistance character be made. In recent years important progress has been made in this field of genetics,

but the necessity for further investigations along these lines is evident to any one who takes up the problem of developing disease-resistant varieties.

There are many well-known cases where a parasite introduced into a new region has caused serious injury to the native plants. One of the most noted cases occurred upon the introduction of the chestnut-blight fungus into the United States. This destructive disease was first observed in the parks of New York City, including Prospect Park adjacent to the Botanic Garden. Our native chestnut proved to be especially susceptible, and as a result it is fast disappearing from our forests. On the other hand the chestnuts in the regions where the parasite was native appear to have developed a high degree of resistance. A somewhat similar situation arises when a host is introduced into a new environment. Apple trees in Europe are not particularly injured by rust. When they were introduced into the United States, the native American cedar-apple rust-fungus severely attacked the introduced varieties, and has created a practical problem in apple culture in certain localities.

During the past year the investigations in plant pathology at the Garden have been concerned with certain phases of this large problem of disease resistance. The investigations with the covered smut (*Ustilago levis*) and loose smut (*U. Avenae*) of oats have been continued. A number of varieties of oats have been futher tested for their resistance to these two smuts. The most interesting results were obtained with some varieties which were received from Wales. This collection of varieties included several belonging to *Avena strigosa*. These have differed in important respects from the strains of *A. strigosa* which had been tested in previous years. Some of the strains from Wales have proved to be highly susceptible to both species of smut.

An extensive series of experiments on the influence of temperature and moisture on the infection of two varieties of oats, *Avena sativa* variety *Victor* and *A. nuda* variety *inermis*, by *Ustilago levis* was carried out. Some very interesting and definite results were obtained. It was found that infection in both varieties occurred over a wide range of temperatures from 5° C. to 30° C. The highest percentages of infection were obtained at

20° or 25° C., depending, however, upon the variety and upon the soil moisture. In general much higher percentages of infection were obtained in the lower soil moistures than in the high moistures. However, these two interacting factors must be considered together. It was further found that the soil reaction influenced the amount of infection. In general slightly acid soils were more favorable for the high infections.

Inheritance of Disease Resistance.—Important progress was also made in studying the inheritance of resistance to *Ustilago Avenae* in the F_2 (second filial) and F_3 (third filial) generations of a cross between a resistant and a susceptible variety of oats.

Relation of Soil Temperature and Moisture to Infection.—Investigations with the covered kernel-smut and loose kernel-smut of sorghums were continued. The most important experiments dealt with the relation of temperature and moisture to infection. Four varieties of sorghums (Blackhull Kafir, Valley Kaoliang, Red Amber Sorgo, and Darso) were used in the experiments. All these varieties were previously found to be susceptible to the loose kernel smut. Darso, however, appeared to be highly resistant to the covered kernel smut.

The experiments demonstrated quite clearly the very great importance of temperature and moisture in infection. In general the highest percentages of infection were obtained at temperatures ranging from 20° C. to 25° C. Infections occurred, however, over a wider range (15° to 35° C.). The infections were much higher in the lower soil moistures. Soil reaction was also an important factor.

During the past year, a paper on a comparison of the susceptibility of sorghums to the loose and covered smuts has been published. An extensive paper embodying the results on the varietal resistance of oats to loose and covered smuts and another on the varietal resistance of sorghums to covered smut have been submitted to the Office of Cereal Investigations, U. S. Department of Agriculture, for publication as bulletins of the Department, since a considerable portion of these investigations were carried on while Dr. Reed was pathologist in that Office.

Mr. James A. Faris, Research Fellow, has continued his studies on the influence of environmental factors on the infection of

barley by the covered smut. During the past year, his experiments have dealt with the influence of soil temperature, moisture, and reaction on the infection of Hannchen barley. He was able to obtain infection over a wide range of temperatures from 5° C. to 30° C. High infections occurred at temperatures from 10° to 25° C. Soil moisture and soil reaction had, however, a very marked influence on the extent of infection. In general the highest percentages of infection at each temperature were obtained in a soil moisture of 50 per cent. as compared with one of 40 per cent., provided the soil was acid in reaction. It is interesting to note that, in many of his experiments, he obtained high percentages of infection—95.8, 97.8, and 97.9 per cent. These results have been embodied in a manuscript which has been accepted for publication in the March, 1924, number of the *American Journal of Botany*. The results also form the basis of a thesis, which has been accepted by Columbia University in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

The papers embodying the results obtained on the influence of environmental factors on the infection of sorghums by loose and covered smut and on the infection of oats by covered smut have been accepted for publication in the *American Journal of Botany*.

The studies on the influence of environmental factors on infection of oats and sorghums by smuts have been carried out cooperatively by Dr. Reed and Mr. Faris.

Genetics and Plant Breeding

Variation and Heredity in Peas.—Investigations of the laws of heredity and variation in plants have been carried on, as in previous years, by Dr. Orland E. White, curator of plant breeding. The investigations have been confined to peas, particularly to studies on the number of linkage groups and the inheritance of height. As a whole, height in garden peas is a very complex character or set of characters, with many gradating differences between the numerous varieties. Height varies from six inches to eight feet, according to the variety. The evidence so far accumulated demonstrates that at least three distinct kinds of genetic factors are primarily concerned in determining the type of height

FIG. 2. The Alfred T. White memorial. Exercises at the unveiling, June 7, 1923. Mr. Frederic B. Pratt speaking. Mr. R. Fulton Cutting, who gave the dedicatory address, is seated at the right of the tablet. At the left of the tablet, in order (right to left), John H. Harman, Commissioner of Parks, Borough of Brooklyn; Mr. Frank Bailey, Chairman, Botanic Garden Governing Committee; Mr. Henry Bacon, Architect; Dr. C. Stuart Gager, Director of the Botanic Garden. The bronze tablet is concealed by a curtain of smilax.

a pea variety may have. There are factors that determine the number of internodes, the length of the internodes (these were studied and discovered by Mendel), and whether the plant is determinate or indeterminate in its growth. The recessive factor for fasciation has a modifying effect by shortening the internodes. A recessive factor for yellow foliage in one type discovered as a mutant also modifies height, by reducing the length, and even the number of internodes in some cases.

The studies on linkage have resulted in one new linked pair being discovered in 1923, with a small percentage of crossing over. Yellow foliage *G* is linked with the ordinary dominant yellow cotyledon color, while green foliage is linked with green cotyledon color. Crossover individuals of both classes—*viz.*, yellow foliage-green cotyledon, and green foliage-yellow cotyledon—have been secured.

Variation in the Boston Fern.—Studies of the variation of the Boston Fern (*Nephrolepis*) and other types have been continued by Dr. R. C. Benedict, resident investigator. In this connection papers have been completed on two interesting groups of variants. The first group is comprised among the bud sports of the Boston Fern, and includes a most remarkable new form obtained from the Pierson establishment at Tarrytown. The leaves of this form develop as small dense spheres of indefinitely branching green filaments, suggesting moss or liverwort growth rather than fern. In addition, these leaves are capable of producing new plants directly from the leaf tissue, a feature found in no other one of the more than two hundred bud variations of the Boston Fern, nor among the wild species of the genus *Nephrolepis*.

The second group of variations referred to consists of three generations of spore-grown forms raised from the only spore-fertile sport in the whole Boston fern series. This group includes many distinct new variations and constitutes a new chapter in the variation of the Boston fern group.

Lack of greenhouse space for the cultivation of the very large number of distinct varieties already on hand and continuing to appear constitutes a serious restriction to the best prosecution of the study of these forms. During the winter it is necessary to maintain the greater number of the accessioned forms as single

plants in order to make space for the experimental culture of a few types. This means that from time to time, some of the varieties represented only by a single plant are accidentally lost, and disappear from the collection. In the summer an extension of space has been possible through the use of a lath-shaded area in the experimntal ground out-of-doors, and through the temporary use of space in the children's greenhouses. As a by-product of the experimental cultures, there were again more than a thousand plants on which observations had been completed, which were turned over to the Department of Elementary Instruction.

Cooperation with Florists.—A continuation of visits and correspondence with florists interested in the culture of ferns together with some distribution of sets of varieties for experimental purposes, and of articles in florists' trade press, have constituted the cooperative work for 1923.

Ecology

Research on the Forests of Long Island was continued during the year, especially with reference to the occurrence of the Pitch Pine (*Pinus rigida*) on Long Island and on Mt. Desert Island, Maine. Weekly readings of instruments measuring evaporation, and soil temperatures at different depths, were secured both here and in Maine, the latter in cooperation with Major Barrington Moore. The results of this work on the vegetation of Mount Desert Island are now in course of writing.

Studies of the salt-marsh vegetation on Long Island, begun with the thought of the ultimate agricultural utilization of these tracts, were carried on, and are described in greater detail in the appended report of the Curator of Plants.

The fact that the curator has been obliged to meet a portion of the cost of this field work from his personal funds serves to emphasize how woefully inadequate our resources for scientific work are in comparison to our needs.

Plant Classification

Studies of floral structures from an evolutionary point of view have been continued by Dr. Gundersen. The old divisions of dicotyledons, based upon absence, presence, or union of petals,

are evidently largely artificial. Yet no one has so far brought convincing evidence for other lines of separation of this most numerous and important group of plants. Evidence is gradually accumulating that most of the various groups presenting parietal and central placentation belong together, forming a branch or branches from the primitive, axile placentation of the magnolia group. During 1923 comparisons of vegetative, floral, and, to some extent, of seed characters have been made, especially between the Caryophyllaceae, Frankeniaceae and Plumbaginaceae. These studies indicate that the Frankeniaceae may, apparently, be considered as primitive Caryophyllaceae, establishing a probable link between Parietales and Centrospermae.

During the summer Dr. Gundersen also continued observations on plant distribution at elevations from 2,000 to 4,000 ft., on the north and south slopes of the Big Hollow Valley in the Catskill Mountains.

Public Education

> *"for the giving of instruction in botany to the residents of the City of New York."* [1]
>
> *"to afford such facilities as its resources may be found to permit . . . to teachers and students in the public or private schools of the city, and to other residents of the city, for the study of botany . . . and for that purpose to permit teachers in the schools of the city . . . to bring their students to the botanic garden . . . where, under the supervision of the proper officers of the garden, instruction may be given to such students in the rooms provided therefor, or in the plant houses or grounds of the garden . . . and further to supplement such instruction through lectures by the officers of the botanic garden, or by instructors especially employed for such purpose."* [2]

Public use of the Garden, its grounds, conservatories, library, herbarium, lectures, classes of instruction, and bureau of information, increases annually, and these demands now test our resources to full capacity.

[1] *Agreement* of 1909 between the City of New York and the Brooklyn Institute of Arts and Sciences concerning the establishment of the Brooklyn Botanic Garden, Paragraph Fourth.

[2] *Agreement* of 1909, l.c., Paragraph Thirteenth.

FIG. 3. View in the Japanese Garden, showing drum bridge and stepping stones. Photo by Mr. Harry B. Shaw.

Use of the Garden by the Public and Private Schools continues to increase. Seven hundred and seventy-five classes, accompanied by their teachers, with an enrollment of over 53,000, visited the Garden for instruction during 1923. Of the 365 days in the year approximately 170 are eliminated from the school calendar by vacations, holidays, Saturdays, and Sundays, leaving only about 195 school days when classes might come from the schools. If we make further deductions for the first few days of each school term and the days devoted to examinations (about 35), there remain only about 160 days when classes might be expected. On this basis the average attendance during the year has been nearly five classes or over 330 pupils a day.

These classes came from 89 (over 46 per cent.) of the Public Schools of the Borough. Classes also came from many parochial and other private schools. The service of the Garden to the City schools now extends from Barren Island to the East River, and from Bay Ridge to and into the Borough of Queens. Several classes have come to the Garden from Manhattan schools, and teachers have been registered in our classes from every borough in the City except Richmond (Staten Island).

At present over 90 per cent. of the elementary schools of Brooklyn are availing themselves, in some form or another, of the educational advantages offered by the Garden. From the above statistics one can readily appreciate the extent to which public education in Brooklyn would be impoverished if deprived of the cooperation of the Brooklyn Botanic Garden.

Teachers Conferences.—But the above paragraphs do not tell the whole story. During the year, 391 public school teachers have sought conferences with members of the Botanic Garden staff concerning illustrative materials, lesson planning in nature study, geography, and botany, and other problems involving the instruction of over 146,000 pupils, whose work has been greatly enriched as a result of these conferences.

Botanic Garden Classes and Lectures.—In addition to visiting classes from the schools, our own classes have had an enrollment of nearly 4,000 adults and children, with an attendance of nearly 26,000 as compared to nearly 20,000 in 1922—an increase of about 30 per cent.

The attendance at lectures has been 2,321 adults and 18,096 children—a total of 20,417, as against 1,828 adults, and 16,850 children (a total of 17,678) in 1922, a gain of 15 per cent.

The total attendance at all classes and lectures has reached the highwater mark of approximately 100,000 (99,259)—an approximate increase of 27 per cent. over 1922 and 37 per cent. over 1921. There has been no increase in staff to help carry this large increase in load.

Bureau of Information

As a part of our work of public education the Garden maintains a Bureau of Information on all phases of plant life and gardening, the care of trees in streets and lawn, care of lawns, care of house plants, plant diseases, identification of specimens, possible economic uses of plants, and other items. The number of requests received by mail, telephone, and personal visit increases each year. Requests are continually being received from commercial houses, importers, manufacturers, growers, advertisers, and others concerning various aspects of economic and applied botany. Not uncommonly we are told that information we have supplied has been sought in vain elsewhere.

Public Lectures and Docentry

In addition to the large number of lectures given to special groups, the Botanic Garden has offered two courses of nine lectures free to the public, five in April, and four in October and November. The details of these courses are given in the appended report of the curator of public instruction. The guiding of visitors about the grounds and conservatories is an almost daily occurrence throughout the year, but no statistics have been kept for 1923.

Tenth Anniversary of Our Work of Elementary Instruction.—In connection with the completion of ten years of work in Elementary Instruction Miss Shaw, who has had charge of this work from the beginning, and who has made it such an outstanding success, gave a Public Lecture on Friday afternoon, November 2, summarizing the work and outlining its growth. This growth is expressed numerically by the attendance figures of less than

FIG. 4. Aster "Mauve Cushion," in the Rock Garden.

1,400 for the first year, and nearly 50,000 for the tenth year. This work has become what the teachers regard as an indispensable adjunct to the nature study and geography work in the elementary schools. The figures here given do not include our work with High Schools, but only with Elementary and Grammar Schools.

Tree Planting.—In recognition of Miss Shaw's splendid work during the past ten years she was invited to plant a tree near the Children's Building. The planting was at noon on Thursday, October 25. The tree was a specimen of the silver linden (*Tilia argentea*), about 12 feet high.

Supply of Material to Schools

> "*said party of the second part* [*the Botanic Garden*] *shall, so far as any surplus resources will permit, furnish plants or botanic material for use in the teaching of botany in the public schools of the City of New York, and in case the supply of plants or materials for instruction is not exhausted by the demand of the public schools of the City, such plants and botanic materials may, at the discretion of the party of the second part, be furnished to other educational institutions within said City.*" [1]

Study Material.—During the year over 1,800 teachers have been supplied with living plants and plant parts, leaves, twigs, seedlings, sterilized agar, and other material in quantity for class study. Potted plants to the number of 5,000 (lacking 9) have been supplied to beautify the classrooms of the schools and for study. Every class that visits the Garden accompanied by its teacher takes back a potted plant for its classroom.

Seed Supply.—The supply of two-penny packets of seeds to children for planting in home and school gardens has reached such proportions that a room in the Laboratory Building has been specially fitted up for this work, equipped with seed bins on rollers, and other appointments to facilitate the work. Nearly 160,000 packets were supplied during the year, an increase of more than 30,500 (or nearly 24 per cent.) over a year ago. This increase is greater than the total number distributed when the activity was inaugurated in 1914.

[1] *Agreement* cited on p. 35, Paragraph Eighth.

The number of children supplied exceeded 91,400, indicating a small number of packets supplied to some; but a small number of packets per capita supplied to a large number of young gardeners is better, educationally, than a larger number per capita to fewer children. Many of these children have no possible place to raise plants except in boxes on window sills and fire escapes. The object of this distribution of seeds is to arouse and stimulate in young people a love of gardening by giving them a taste of the pleasure and satisfaction of raising plants from seed—to give them an added interest in life.

The Annual Children's Garden Exhibit is a fitting climax to the year's gardening. The Tenth Annual Exhibit of garden products was held as usual in the rotunda of the Laboratory Building on September 28 and 29. The vegetables and flowers raised by the children surpassed in quality those of any preceding exhibit, thus reflecting, in part, the Botanic Garden's ten years of endeavor along this line. Over $240 worth of books, medals, cups, and other prizes were distributed on October 13 to the boys and girls who, as evidenced by their exhibits, had raised crops of vegetables or flowers of superior merit. In addition to these prizes the Alfred T. White Scholarship of $100 was awarded for the fourth year. As previously reported, this prize is awarded annually to a boy or girl who has taken courses (outside of school hours) for not less than three years at the Brooklyn Botanic Garden, with high grades, who is certified by his high school as standing high in scholarship there, and who expects to enter college with the intention of ultimately engaging in some line of botanical or horticultural work.

Conservation of Native Plants

During 1923 there has been continued the preparation and distribution of special literature relating to the protection of native plants, some of which have been gradually disappearing. A total of nearly three thousand copies of the article *Game laws for ferns and wild flowers,* by Dr. R. C. Benedict, resident investigator, has been finally distributed through the cooperative arrangement between the Brooklyn Botanic Garden and the American Fern Society, together with numerous copies of other articles. The

great amount of correspondence that has developed in this connection has been cared for by Dr. Benedict, who has been one of the leaders in this important movement. The chief event of the year 1923 relating to this conservation movement was the joint meeting at the Garden on May 23, of three organizations, the Wild Flower Preservation Society, the American Fern Society, and the New York Bird and Tree Club, with representatives of other similar organizations from Chicago, Washington, and several eastern states, and of the New York Botanical Garden and the Brooklyn Botanic Garden.

The meeting authorized the appointment of a committee representing the organizations in attendance to take action toward the amendment of the conservation laws of New York State to provide protection for native plants. The meeting was fully reported in the Botanic Garden RECORD for July, 1923. The work of the committee is not yet completed, but proposals for desirable amendments have been practically agreed upon for presentation to the New York State Legislature.

Demonstration Material

During the year, much economic material secured from various sources, but especially by Dr. White on the Mulford Expedition in Brazil and Bolivia (in 1921–22), has been put in a form available for study, exhibition, and teaching purposes. In this collection are specimens illustrating the tapioca, rubber, vanilla, Brazil nut, and cocoa industries; also jars of many tropical fruits, such as the bread-fruit, guava, cherimoya, cupu-assu, camaruru, the peach-palm, and others.

Library

> "*such sum or sums so appropriated [by the City] shall be expended by the party of the second part for the care and maintenance of . . . its . . . library and collections . . . for furnishing books, charts and other publications relating to botany and required for use in connection with the said botanic garden.*" [1]

The City has never been asked to make an appropriation for the purchase of books or other publications. The Garden library

[1] *Agreement* cited on p. 35, Paragraph Sixth.

is open to the public free daily, except Sundays and holidays. While the collection of over 9,800 books and over 6,600 pamphlets has been built up primarily with reference to use in connection with the botanic garden (in conformity with the *Agreement* above cited), the needs of the scientific and lay public have been kept constantly in mind, and the number of readers steadily increases. The 709 technical and popular or semi-popular periodical publications that were being received at the close of the year, dealing with plant life or closely related subjects, is an increase of 111 over a year ago. This is an increase of nearly 19 per cent. over 1922 and of nearly 21 per cent. over 1921.

The number of books has increased during 1923 by over 14 per cent. and the number of pamphlets by 10 per cent.

The library is now in need of increased shelving and of a much larger fund to provide, not only for purchases and subscriptions, but also for the annual binding. Counting 10,434 parts of publications, 1,219 books, and 629 pamphlets, there were received during the year 12,282 pieces of printed matter (1,000 per month), as against 7,577 pieces received a year ago. This increase, which will continue during 1924, combined with the increasing number of readers to be served, indicates the need of more assistance.

Herbaria

Phanerogamic.—The appended report of the curator of plants and plantations records a total of 2,191 specimens added to the herbarium of flowering plants and ferns. These have all been obtained by gift, exchange, or collection. Special attention is called to the curator's comment that no money has been available for the purchase of specimens during the past two years.

Cryptogamic.—Accessions of 2,168 specimens are reported by the curator in charge of this section of the herbarium. Of these, 1,312 were specimens of fungi, and 856 specimens of algae, lichens, liverworts and mosses. The lack of adequate herbarium assistance, to which the curator calls attention, is a serious obstacle to the proper care and fullest utilization of this valuable collection.

The total number of specimens in both herbaria exceeds 231,000.

FIG. 5. Biology class, with teacher, from Stuyvesant high school, studying succulents in House No. 6 of the conservatories.

Plantations and Grounds

"*for the collection and culture of plants, flowers, shrubs and trees . . . and for the prosecution and exhibition of ornamental and decorative horticulture and gardening, and for the entertainment, recreation and instruction of the people.*" [1]

In order to fulfill the entire purpose of the grounds, as specified in the above quotation, we have endeavored to make the garden the most beautiful spot in Greater New York, while at the same time arranging the plantations in accordance with botanical principles, so that the well-labeled collections will serve to instruct as well as to afford entertainment and recreation. We are now in frequent receipt of testimonials which go the entire length of pronouncing the Brooklyn Botanic Garden the most beautiful spot in the City.

The Rock Garden, constructed in 1916, was for a number of years the only rock garden in a public park in America. It has been annually improved and gradually enlarged, and has been the means of arousing an interest in rock gardening and saxitile plants throughout the United States. Numerous private rock gardens and two or three in public parks are a direct or indirect result of the interest aroused in this type of gardening by our own rockery and by the Botanic Garden *Leaflets* and numerous magazine articles on this subject prepared by our horticulturist, Mr. Free, under whose immediate supervision the rockery was constructed and developed. To stimulate and foster an interest in gardening of any kind is one of the most substantial results that can follow from our own plantations. Notwithstanding the garden-club movement, which has gathered a considerable following in America during the past ten or twelve years, and the several garden magazines now being published in the United States, a genuine interest in gardening, for its own sake (as distinguished from a social interest in it), is still in its infancy in this country. The Brooklyn Botanic Garden aims to foster this interest in every possible way.

The Japanese Garden has been improved in minor details during the year, and still remains, so far as we are informed, the only

[1] Laws of New York, 1911, l.c., Section 1.

example of a real Japanese garden, planned, constructed, and (in part) maintained by Japanese, in a public park in America, with the exception of the one in Golden Gate Park, San Francisco. The cost of the improvements was met this year (as for several years past) by a gift of $500 by a donor who wishes to remain anonymous.

The Iris Collection, extending for about 600 feet on either side of the brook, has been replanted, primarily for the purpose of securing better cultural conditions for the forms of Japanese Iris.

The Systematic Section has been enriched and revised in various orders and families, and other work done as noted in the appended report of the curator of plants.

Ecological Section.—In addition to his genetic investigations, Doctor White, curator of plant breeding, has continued in charge of the Ecological Section on the grounds, where the effect of various environmental factors in modifying the hereditary expression of various plants is demonstrated by living individuals. For the first time in the Garden the relation between the forming of seed in the *Yucca,* or Spanish bayonet plant, and the moth, *Pronuba,* could be easily demonstrated, owing to the large number of the moths. The rapidity of multiplication of the water fern, *Azolla,* in this section created enough interest to reach many newspapers outside of New York, as this plant, escaping from the swamp, filled all the pools in the brook below the swamp by autumn. Two other demonstrations were striking, both relating to parasitism—the dodder (*Cuscuta*) as a parasite on many different plants, particularly striking on the sunflower and Jerusalem artichoke, and the broom-rapes (*Orobanche* sp.) that live on the roots of hemp, English ivy, and other plants. In Southeastern Europe, species of these broom-rapes are a serious pest on cultivated crops such as potatoes. The species we are growing, however, are not dangerous in this country.

The Horticultural planting has included about 50,000 bulbs, "naturalized" in the lawns (about 40,000), or planted in the Rock Garden, and in beds, as noted more in detail in the January, 1924 issue of the RECORD.

The Collections of Living Plants have increased by gift and exchange, and by purchase solely from private funds for which

contributions are annually solicited. The labeling of these exhibits has also progressed during the year, under the immediate supervision of Dr. Gundersen, and this it is that gives the exhibits of living plants their educational value. One may almost daily see visitors copying these labels, and the gardeners are constantly receiving inquiries about them and the plants.

A beginning was made, during the year, of installing large "blanket labels," at the entrances to the various plant Orders, giving a list of the Families in the Order, and other information as to geographic range, etc.

Our plantations have now reached a stage of development where they are proving a rich source of suggestion to persons who have small gardens and larger private places. As one of numerous instances of this, inquiries have been received from several states and from one foreign country concerning seeds and cultural requirements of our collection of hardy asters.

Undeveloped Area

The development of the grounds has proceeded slowly on account of the shortage of labor. The area of about three acres between the Brooklyn Museum and Mt. Prospect Reservoir is still largely undeveloped. This area has a frontage on Eastern Parkway, and the entrance gate there, near the I. R. T. subway exits, is one of our most used entrances.

Conservatories

The conservatories have been maintained in a good state of upkeep, and numerous new species have been added. The installation of blanket labels has begun during the year, each label giving information (in addition to name and range) concerning plants of popular or economic interest, such as tea, chocolate tree (*Theobroma cacao*), Pepper (*Piper nigrum*), cocoanut, banana, vanilla, Orchid Family, Begonia Family, and others. These labels, prepared by Dr. Gundersen, have, like the blanket labels on the grounds, also prepared by him, added greatly to the educational value of the exhibits, especially for school classes in botany and geography.

The International Seed Exchange

Seeking to advance the subject of plant classification from a practical as well as scientific point of view, the Garden has, during the year, addressed to seventy-five foreign botanic gardens that issue annual seed lists three communications regarding these lists. The first (January) called attention to the existing great diversity of arrangement, and invited discussion as to possible unification.

In a second circular (July) were printed the main parts of the twenty-two replies to the first one. From these it appeared that a majority of Gardens preferred an arrangement by families listed alphabetically under larger groups. We then submitted three questions as to what should be the main groups, and the names and scope of families. These communications were suggested and prepared by Dr. Gundersen. The object is to establish, if possible, approximate international uniformity as to plant families.

The twenty replies received were published in the third (November) communication. It appeared that a majority of gardens prefer the groups *Bryophyta, Pteridophyta, Gymnospermae, Dicotyledoneae, Monocotyledoneae,* in the order given. For the names and scope of families the Engler system was preferred. The responses and results so far obtained are very encouraging. Our own Seed List has been rearranged to conform to the majority wishes, as have also several others of those so far received.

We intend soon to prepare an index of botanic gardens that publish seed lists, and also a list of genera as used in all the seed lists, in order to call attention more definitely to the existing differences in usage.

Alfred T. White Memorial

An account of the unveiling of the Alfred T. White memorial tablet and seat was given in the Botanic Garden RECORD for July, 1923. As there stated, this memorial was a gift from former friends of Mr. White, most of whom had been associated with him in one or more of his innumerable works for the public good in Brooklyn. The names of the Committee that raised the fund and secured the memorial were given in the July RECORD. The names of the contributors are given in Appendix 1 of this Report. An unexpended balance from this fund, amounting to $3,889.85,

has been turned over to the Botanic Garden authorities as a permanent fund to be invested and the income used for the up-keep of the memorial and its immediate surroundings. By vote of the Governing Committee this fund will be included in the Endowment Increment Plan of the Garden.

Ninth Annual Spring Inspection

Nearly 600 trustees, members, members of the Woman's Auxiliary, and friends attended the Ninth Annual Spring Inspection on Tuesday, May 9. The new Boys and Girls Club Room in the Laboratory Building, the gift of the late Mrs. George D. Pratt and Mr. Pratt, was formally opened on this occasion. There were also exhibited nine of the minature gardens designed by members of the Garden Club of America, and first exhibited at the 1923 Annual Flower Show in Manhattan. Other exhibits included a collection of photographs of small gardens, loaned by The Society of Little Gardens; a set of colored posters showing the use of plants and plant parts in design, made by the nature-art class of high school pupils at the Botanic Garden under the direction of Miss P. F. Pond, chairman of the art department of the Girls High School, Brooklyn. The Pasteur-Mendel exhibit, first installed in connection with the Pasteur-Mendel centenary program held at the Garden on April 19, was also shown, with several new exhibits added. On the north wall of the exhibit room were displayed 33 beautifully colored photographs illustrating various phases of forest conservation, and loaned by the U. S. Bureau of Forestry.

Vandalism

The destruction of public property, and the misuse of public buildings and grounds *by the public* is almost, if not quite, beyond the belief of one who has never had the responsibility of administering public buildings and grounds. The vast majority of the public is, of course (and fortunately), law abiding and appreciative; otherwise it would hardly be possible to open to public use beautifully planted parks and gardens, and beautiful public buildings and collections. The small minority never identifies itself with the public—never seems to have any sense of joint owner-

ship of public parks and buildings, never seems to be aware that all have equal rights. Therefore they freely appropriate to themselves flowers and plants, books and other objects, and despoil and disfigure what the servants of the public endeavor to maintain, at public (and private) expense, for the pleasure and profit of all. As Mr. Caparn, of the Garden Staff, noted in a recent article, their attitude of mind is tersely expressed by the answer they so often give when remonstrated with, or when called to court, "*Ze Ceety pays.*"

Vandalism is not confined to the pranks of immature and mischievous children; some of our worst offenders are adults—both men and women. The Botanic Garden suffers distressingly from vandalism, and we shall never be able adequately to meet the situation until we have a practically unclimbable fence, suitable gates that will keep people out of the garden after hours, and funds to employ a sufficient number of competent uniformed guards every day in the year. Such protection we now almost wholly lack.

Maintenance of Plant

The failure of the City administration, during the past four or five years, to grant our repeated requests for funds for new construction, and the appropriation of quite inadequate amounts for repairs and replacements have resulted in a steady deterioration of certain parts of the property, such as the fence enclosing the garden, gates, walks, temporary bridges and steps, and other structures. The longer these repairs and replacements are postponed the greater will be the ultimate cost. It has been necessary to close to the public one walk and one flight of steps for lack of funds (asked for but not granted) to make the repairs and alterations necessary for continued public use.

Increasing Service: Diminished Resources

The value of an institution is seldom adequately indicated by a quantitative statement; the nature and quality of its work, and the extent to which it meets existing needs are the important points. Figures of attendance, however, do reflect the extent to which the institution is needed and used by the public. It is self-

evident, also, that diminishing financial support makes it correspondingly difficult for an institution to meet greatly increasing demands for service. Quantitatively stated, public use and public demands upon the Brooklyn Botanic Garden have increased from 7 to 233 per cent. (depending upon the activity) during the past two years, as shown in the following statement which gives the percentages of increase of 1923 as against 1921. In the meantime our municipal appropriation for maintenance has decreased 12 per cent.

PERCENTAGES OF INCREASE AND DECREASE, 1921–1923

		Per Cent.
1. Number of visiting classes	Increase	65
2. Attendance of visiting classes	"	100
3. Percentage of schools using the Garden	"	16
4. Number of potted plants placed in schoolrooms	"	233
5. Number of seed packets supplied to children	"	22
6. Attendance at Botanic Garden Classes	"	21
7. Total attendance, all lectures and classes	"	37
8. Attendance in library	"	28
9. Attendance at conservatories	"	7
10. Number of pages of research published (1741)	"	26
11. Municipal appropriation for maintenance	**Decrease**	**12**

The inference from the above statement does not need to be pointed out. *If the Botanic Garden is to continue to meet the needs and demands of the local community, and to discharge its educational and scientific obligations—the activities for which it was established—it must have adequate financial support. This it has not had for several years.*

Needs of the Garden

The shortest treatment of this topic would be to refer readers to the preceding Annual Report, for most of the needs there listed remain wholly or largely unfulfilled. They should be kept continually before us until met. The situation developing as a result of the long-continued failure to meet these needs becomes more serious each year. They are nearly all summed up in the one urgent need of additional endowment.

For the first time in the history of the Garden our annual budget (that for 1924) has been adopted at a total figure of about $1,000

in excess of assured income. Also for the first time in the history of the Garden we have closed a fiscal year (1923) with a *de facto* deficit. The financial statements which accompany this report do not show a deficit because a transfer has been made as a temporary loan from a restricted account which should be reimbursed in 1924.

Endowment.—The director will welcome an opportunity to show to any one interested an itemized statement indicating the immediate and pressing need of an increased endowment of not less than $500,000. To realize adopted plans more than twice that amount is necessary. A list (not complete) of objects for which additional endowment income is needed follows:

1. *To make curatorial salaries more nearly adequate,* considering the professional requirements of incumbents and the living costs in a city of this size. Our present salaries are below what is paid in the larger and better universities, and in other scientific institutions comparable to the Botanic Garden. They are below what is paid in other scientific and educational institutions in this city for positions of equal (or in some cases of lower) requirements for appointment.

2. *To provide for certain greatly needed new positions.* During the past few years many phases of our work have expanded out of all proportion to increase in staff. Much important work remains wholly untouched for lack of adequate personnel.

3. *To meet the need of larger annual expenditures* for library, collections of living plants, herbarium, illustrative material, public lectures, and other similar purposes.

4. *Publication*—scientific, popular, administrative.

5. *Exploration, field work, apparatus,* and other equipment and expenses incidental to our scientific and educational work.

6. *Research.* To place on a permanent and adequate basis important research projects now in hand but financed only temporarily or inadequately. To extend this work.

7. *Beautification of the grounds.*

8. To inaugurate a system of *Retiring Allowances* for members of staff and other employees.

The items noted above are only some of the more important for which increased annual income is needed. As in the case of these

items, there should be restated from preceding reports the two following needs:

Gateways.—As noted in my preceding report, the need of suitable gateways at each of our seven public entrances affords an excellent opportunity for private philanthropy that would meet an important need of the Botanic Garden, serve to beautify the City, and which might, if desired, be made a personal memorial.

Service Yard and Propagating Houses.—There should be constantly kept in mind a need which becomes more urgent each year—namely, additional land within easy access of the Garden to serve as a nursery and experimental plot, and on which propagation houses could be erected. Portions of the Garden which have hitherto been utilized for nursery and service yard purposes have been gradually brought into the developed area open to the public so that, as our need has increased, the accommodations have decreased. The importance of this need can hardly be over-emphasized.

Acknowledgments

The numerous gifts listed on pages 82–87 have been acknowledged, as received, with the thanks of the Governing Committee. It is a pleasure to call attention to them here and to make public acknowledgment of our appreciation to the donors.

In addition to the donors of gifts, the Garden is greatly indebted to many officials, members of the Woman's Auxiliary, and other friends for support, suggestions, cooperation, and other services, all of which have contributed substantially to such success as has marked our efforts during the year.

The second annual Organization Dinner, held in the rotunda of the Laboratory Building on April 25, 1923, with 58 persons attending, reflected the fine group spirit that permeates the Botanic Garden organization.

The annual reports of heads of departments, financial statements, and Appendices 1–8 follow as integral parts of this report.

Respectfully submitted,

C. Stuart Gager,

Director.

FIG. 6. Porch of the children's building, July 23, 1923. The children's gardens beyond. It isn't so bad to have to stay in town all summer if your city has a botanic garden with a children's department.

REPORT OF THE CURATOR OF PLANTS AND PLANTATIONS FOR 1923

DR. C. STUART GAGER, DIRECTOR.

Sir: I take pleasure in submitting my report for the thirteenth year of my connection with the Botanic Garden, ending December 31, 1923.

As in previous years the gardening force has been under the direct supervision of Mr. Free, and the laboring force under Mr. Herman Kolsh. Partly from lack of funds, and partly because so much of our once rather wild and untamed grounds are now under cultivation of some sort, there has been less new construction and planting than in any recent year.

There remains only the area between the Museum and the Reservoir to be put down to permanent lawn, and planted according to already accepted plans. The last of the grading of this was completed during the year, some of it covered with top-soil, and some of the area is still in process of soil improvement. During 1924 the area should all be put down to permanent lawn.

As construction naturally gives way to maintenance we should as soon as possible so arrange our outdoor forces that certain sections of the grounds are put in charge of one or two men, gardeners or laborers as the situation may demand. The obviously good results of such procedure in the Japanese Garden point the way toward what is evidently the best method of securing both adequate care and policing of the rest of our grounds. Men assigned to such tracts take a greater interest and pride in them than if they are daily sent to different parts of the grounds, as we have been forced to do by construction demands up to now.

The gardening force increased the beds devoted to perennial asters, which proved such a success last year. A large and attractive display of Cannas was made among the monocotyledonous families, involving a rearrangement of these beds. Altogether there were 480 plants in 32 varieties, given by the Conard and Jones Company of West Grove, Pa. On the south embankment of the museum site over 1,000 small plants of Crataegus were set out as a temporary exhibit, and thousands of seeds of Crataegus were planted at the same place in the autumn. In the fall about

50,000 bulbs, including 83 varieties of Tulips, Narcissus, Frittilarias, Scillas, etc., were planted, some in the beds in the monocotyledon section, the majority on the lawns and embankments. The Iris collection was also replanted, and new borders made for it.

Labeling and Record Work

The number of labels made was as follows:

Steel labels for the beds	456
Lead labels for the woody plants	106
Large wood labels	12
Small wood labels	99
Signs for the bulletin boards	85
Notices	116
Large charts	5
Story labels, on wood	21
Miscellaneous small signs	104
Total	1,004

Besides many old signs repaired and re-varnished, including the labels for the Ecological Section and the Iris plantations.

Consignment numbers 23-1 to 23-62 were assigned during the year to 639 species and varieties of living plants, which were received either by collection, exchange, gift, or purchase, as noted under Miscellaneous Statistics and in Appendix I. The plants raised from seed included 443 species and varieties.

"Story labels" were introduced into the conservatories for some of the more interesting plants, telling the story of their origin, distribution and economic uses. About 680 show labels were made for plants in the conservatories and on the grounds. Service labels were made for plants in the rock garden, cold frames, propagating houses and greenhouses.

In response to requests resulting from the 1922 seed list, which was mailed in the spring of this year, 2,555 packets of seeds were sent out on an exchange basis, while 1,340 packets were received in exchange. Thirty-two packets were received by collection and fifteen by gift.

Phanerogamic Herbarium

The total number of herbarium specimens acquired was 2,191, of which 723 were gifts, 1,206 received by exchange, 262 by col-

lection. No money has been spent during the past two years for the purchase of herbarium specimens.

Some of the more important additions to the herbarium during the past year are as follows: from the U. S. National Museum, 1,045 miscellaneous specimens as an exchange; from Mr. R. A. Pope, of Anchorage, Alaska, a gift of 285 specimens collected in Alaska; from the Botanic Garden of Cluj, Roumania, 161 Roumanian plants as an exchange. Dr. Orland E. White, who was a member of the Mulford Biological Exploration of the Amazon Basin, has, during the year, turned over to the herbarium 260 specimens of Bolivian plants. Another notable gift is from the American Museum of Natural History, comprising 279 specimens from Polynesia, collected by the Whitney South Sea Expedition. Thirty-one of these specimens were mounted and loaned to the American Museum for a public exhibit during December.

Only 820 specimens were mounted this year, owing to lack of assistance and to the crowded condition of the herbarium. During June and July the collection of duplicate herbarium specimens was looked over. A set of 750 specimens, mostly native plants, was arranged and sent to Dr. H. Zerny, of the Naturhistorischen Museum at Wien, Austria, in exchange for a collection of Austrian plants received some time ago.

Hough's *American Woods,* a set of thirteen volumes of specially fine wood cuts, was rearranged systematically in order to facilitate their use in the herbarium.

Miscellaneous Statistics

Phanerogamic Herbarium

Distribution by Exchange

To Dr. L. H. Bailey, Ithaca, New York, 427 pressed specimens of plants cultivated in the Brooklyn Botanic Garden.

To Dr. H. Zerny, Naturhistorischen Museum, Wien, Austria, 750 pressed specimens, most of which were North American plants.

Specimens Received by Exchange

From the U. S. National Museum, Smithsonian Institution, Washington, D. C., 1,045 miscellaneous herbarium specimens.

From Grădina Botanica a Universität, Cluj, Roumania, 161 specimens collected in Roumania.

Specimens Received by Collection

From Dr. Orland E. White, with the Mulford Exploration of the Amazon Basin, 260 specimens collected in Bolivia; one specimen of *Oxalis acetosella* from Maplecrest, New York.

From Mr. Norman Taylor, one specimen from North Stonington, Conn.

Living Plants Obtained by Collection

From Dr. C. Stuart Gager, 2 specimens collected in Bergen County, N. J.

Living Plants Obtained by Loan

From Mr. William Tricker, Arlington, N. J., one rare specimen of water-lily, Nymphaea "Mrs. A. G. Pring."

Living Plants Obtained by Purchase

The number of species and varieties of living plants purchased during the year was 271.

Living Plants Obtained by Exchange

Arnold Arboretum, Jamaica Plain, Mass. (1).
Mr. R. Cameron, Castle Hill, Ipswich, Mass. (2).
Hicks' Nurseries, Westbury, L. I. (1).
Mr. Clarence Lown, Poughkeepsie, N. Y. (48).
Mr. H. Muller, Westbury, L. I. (1 plant, 6 cuttings).
New York Botanical Garden, Bronx Park, New York City (131 plants, 13 cuttings).
Botanic Garden of the University of Pennsylvania, Phila. (1).
Prospect Park, Brooklyn, N. Y. (5 plants, 6 cuttings).
Mr. Frank Reppa, 19 N. Vermont St., Brooklyn, N. Y. (3).
U. S. D. A. Office of Foreign Seed & Plant Introduction, Bell, Glen Dale, Md. (3).
Vassar College, Poughkeepsie, N. Y. (3).
Mr. F. Weinberg, 120 N. Gates St., Los Angeles, Cal. (61).

Living Plants Distributed by Exchange

During the past year 272 living plants were distributed to other institutions.

Seed Distributed to Other Institutions

On an exchange basis, 2,255 packets of seeds were distributed to other institutions.

Seeds Received by Exchange

On an exchange basis, 1,340 packets of seeds were received from other institutions.

Seeds Collected

By Dr. C. Stuart Gager, 19 packets collected in Canton, Me.
By Mr. Montague Free, 12 packets from Ohiopyle, Penn.
By Dr. Orland E. White, with the Mulford Biological Expedition, 1 packet from Bolivia.

Seeds Purchased

Fifty-two packets of seeds were purchased during the year 1923.
All gifts of living plants, seeds, cuttings, and herbarium specimens are listed under Appendix I.

Personal Activities

Part one of volume two of the Memoirs of the Garden, comprising the first part of the results of my study of the vegetation of Long Island, was issued on June 11. Dealing particularly with Montauk, it comprises a study of the conflict between forest and grassland, which is there of peculiar intensity. The second section of "The Vegetation of Land Island," which deals with the forests of the Island, is now in course of preparation. A factor directly affecting this is the great velocity of the wind blowing over certain parts of Long Island, the direct effects of which on transpiration and growth are not yet understood. Other than the work of Leonard Hill in England, and Briggs and Shantz in this country, almost nothing of an experimental nature has been done on the ecological effects of wind on transpiration

FIG. 7. Class in plant culture in the children's greenhouse. One of three similar houses in the range. This work is a pre-requisite to having a garden in the children's garden.

and growth. It is proposed to start a set of experiments on this during the coming summer, as the information thus gleaned is needed for a right understanding of the germination and growth of Long Island forest trees, as well as the associated vegetation.

During the growing season atmometer records and soil temperature records were secured weekly from a Pitch Pine station near Coram, in harmony with synchronous records being taken in connection with my work with Major Barrington Moore on the vegetation of Mt. Desert Island, and with similar records taken by the New York Botanical Garden, the Yale Forest School, and the Forest School of Syracuse University.

The work of the Nassau County Mosquito Extermination Commission in ditching the salt marshes has so changed some of them, and the changes have such far-reaching practical possibilities, that a study of the vegetation of these, and the peat and muck underlying them was carried on. Such factors of the environment as the changes in temperature, specific gravity, and hydrogen-ion concentration of the water of the marshes at the surface and at different depths, was studied in considerable detail. The changes of tide levels, both daily, monthly, and as between summer and autumn, affect the marshes so profoundly that I felt obliged to carry on this work late into the fall, and at my own expense, after Garden appropriations for field work were exhausted. There is still a good deal of work in connection with these marshes to be done, particularly during the very high tides that come at the Spring Equinox.

The field work on Mt. Desert Island vegetation is now completed, and the results of this study, extending over four summers, are in preparation for volume three of the Memoirs of the Garden. The study has been made possible by Garden appropriations and by the very pleasant hospitality of my friend and colleague in the work, Major Barrington Moore.

Respectfully submitted,

NORMAN TAYLOR,

Curator of Plants and Plantations.

REPORT OF THE CURATOR OF PUBLIC INSTRUCTION FOR 1923

DR. C. STUART GAGER, DIRECTOR.

Sir: I beg to submit herewith my report for the year ending December 31, 1923:

Public Lectures

The 1923 public lecture course was inaugurated by two presentations of the new motion picture, "Evolution, from the birth of planets to the age of man." In both of these showings, which occurred on Friday afternoon, April 6, and Sunday afternoon, April 8, the capacity of the auditorium was taxed to its utmost, and many persons stood throughout the entire performance. Preceding the public presentation on Friday, there was a special showing for biology teachers and pupils of the Brooklyn high schools, at which every seat in the auditorium was taken. By special request the reels were exhibited again on November 7 and in both the mornings and afternoons of November 9 and 10 for high school classes in biology, again to almost capacity audiences. There were eight showings in all.

Subsequently, in the spring and fall, the following public lectures were delivered:

1. April 13.—Trees in Nature and Art. Dr. A. F. Blakeslee, Resident Investigator in Plant Genetics, Station for Experimental Evolution, Cold Spring Harbor, L. I.

2. April 20.—Forestry in the United States. Professor Henry Solon Graves, Dean, School of Forestry, Yale University.

3. April 27.—What's New in the Garden. Mr. Edward I. Farrington, Editor of Horticulture, Boston, Mass.

4. October 5.—The Life of the Plant. Dr. Arthur Harmount Graves, Curator of Public Instruction, Brooklyn Botanic Garden.

5. October 19.—Bulbs and Their Allies. Professor Hugh Findlay, Assistant Professor of Agriculture, Columbia University.

6. October 26.—The Evolution of Flowers. Dr. Alfred Gundersen, Associate Curator of Plants, Brooklyn Botanic Garden.

7. November 2.—Ten Years of Garden Work with Brooklyn Boys and Girls. Miss Ellen Eddy Shaw, Curator of Elementary Instruction, Brooklyn Botanic Garden.

Pasteur-Mendel Celebration

In recognition of the hundredth anniversary of the births of Pasteur and Mendel, informal exercises were held at the Laboratory Building on April 19. Dr. O. E. White, Curator of Plant Breeding, spoke on the life and work of Mendel; and Dr. G. M. Reed, Curator of Plant Pathology, reviewed Pasteur's career. In connection with the celebration, exhibits of apparatus, plant material, photographs, and original publications and books illustrating the lives and discoveries of these pioneers in science were installed in the Library and in the central rotunda of the Laboratory Building. The exercises were well attended, mainly by high school pupils and biology teachers.

Study Material for High Schools

This field of service has grown by leaps and bounds. During 1921 there were only 27 requests from the various high schools for materials, such as agar for the study of bacteria and molds, for Spirogyra, Elodea, fern prothallia, etc. In 1922, there were 48 requests; in 1923, 110.

Already, in 1922, the demands on my time were so great that I could no longer properly carry on this branch of the work single handed, and until a full-time assistant could be appointed Mrs. Hill acted as part-time assistant. We were fortunate in securing the services of Miss Charlotte S. Young, for many years connected with the Biology Department of Erasmus Hall High School, to assist in the preparation of this study material and also in other activities of the department. Since the date of Miss Young's appointment, September 1, 1923, we have received 76 requests for material—or an average of nearly one a day—and for this period more than in all the two years of 1921 and 1922. For the whole year of 1923 the requests have been more than double the number (48) of the previous year. Six hundred sixty-four petri dishes (as against 358 last year) and 12 flasks of agar were filled for the schools. We have supplied every high school in the Borough of Brooklyn as well as some in Queens and Manhattan with study material of some sort.

The field for this work is very large, and it is evidently of great value to the schools, enriching their text book study by plants and plant materials which they could otherwise obtain only with difficulty, if at all. I feel that we are just beginning to realize its possibilities, and yet without additional equipment, particularly an additional greenhouse, the limit of our facilities will soon be reached.

Classes and Attendance

The training course for gardeners, in which we are cooperating with the U. S. Veterans Bureau, continues in operation, the major part of the instruction being given by Mr. Free, assisted by Dr. Gundersen, Dr. White, Mr. Stoll, and myself.

The total attendance this year at all our classes and lectures was 99,259, an increase of more than 25 per cent. over last year, which was itself an increase of nearly 25 per cent. over the year before. This increase may well continue in the future, but it is doubtful whether it can go on at the same rate, hampered as we are by insufficient funds for publicity, lectures, and instruction.

The attendance at the Garden, as shown by registration at the entrance gates, was 408,520, the largest figure in the Garden's history, if we except 1917, when, on account of the war, interest in vegetable crops and gardening was greatly stimulated. The following table shows the attendance and registration for 1923:

TABLE I

ATTENDANCE AT THE GARDEN DURING 1923

	Jan.	Feb.	Mar.	Apr.	May	June	July
At regular classes	751	1,041	1,970	1,836	2,133	1,281	4,065
At visiting classes	419	592	211	7,121	11,740	10,516	0
At lectures to children	145	234	120	3,347	2,335	2,747	0
At lectures to adults	0	60	0	1,630	310	0	0
At conservatories	729	754	1,336	1,344	3,288	1,772	1,851
Total registration at gates	10,790	12,480	23,774	36,709	65,263	59,364	33,500

	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Totals
At regular classes	4,950	2,568	2,075	1,498	1,542	25,710
At visiting classes	0	120	10,847	9,586	1,980	53,132
At lectures to children	0	205	4,287	3,586	1,090	18,096
At lectures to adults	0	0	251	70	0	2,321
At conservatories	1,579	1,909	2,403	2,042	1,408	20,415
Total registration at gates	44,991	40,845	29,334	34,013	17,457	408,520

Personal Classwork

In 1923, besides devoting an average of two afternoons a week to the teaching of botany in the gardener's training school, I conducted two public courses, one in the spring, on the trees and shrubs of Brooklyn and vicinity, and the other in the fall, on trees and shrubs in their winter condition. In collaboration with Dr. Gundersen I delivered part of the lectures in the public course in the spring on the "Evolution and Classification of Plants." Also, once a week, I have conducted a course in General Botany attended by teachers of nature study and biology.

In Boy Scout work, I was appointed during the past year special examiner by the Brooklyn Council of Boy Scouts in the following subjects: agriculture, botany, conservation, forestry, and gardening. Several tests in these topics have been conducted.

Editorial Work

During the year I have continued to serve on the Editorial Board of the American Journal of Botany, as well as acting as Assistant Editor of the Botanical Education section of Botanical Abstracts.

Publicity

In this connection, it may be noted that attractive colored posters descriptive of the Garden and its various features have been framed and placed in all the high schools and high school annexes of the Borough, as well as in the principal libraries.

We have continued our policy of sending to the various Brooklyn and New York papers weekly instalments of news items relating to the Garden, in order that the public may be kept informed about the lectures, the commencement of courses, plants in bloom, new plants added to the collections, results of scientific research, and other activities. The papers have maintained the hearty support of the previous years, devoting from a few inches to half a page to Brooklyn Botanic Garden items. Two Long Island papers, the Garden City News, and the Long Island Daily Press and Farmer, have signified their desire to receive the weekly notes. By the purchase of a mimeograph, this work is much simplified and its possibilities increased; moreover the machine is

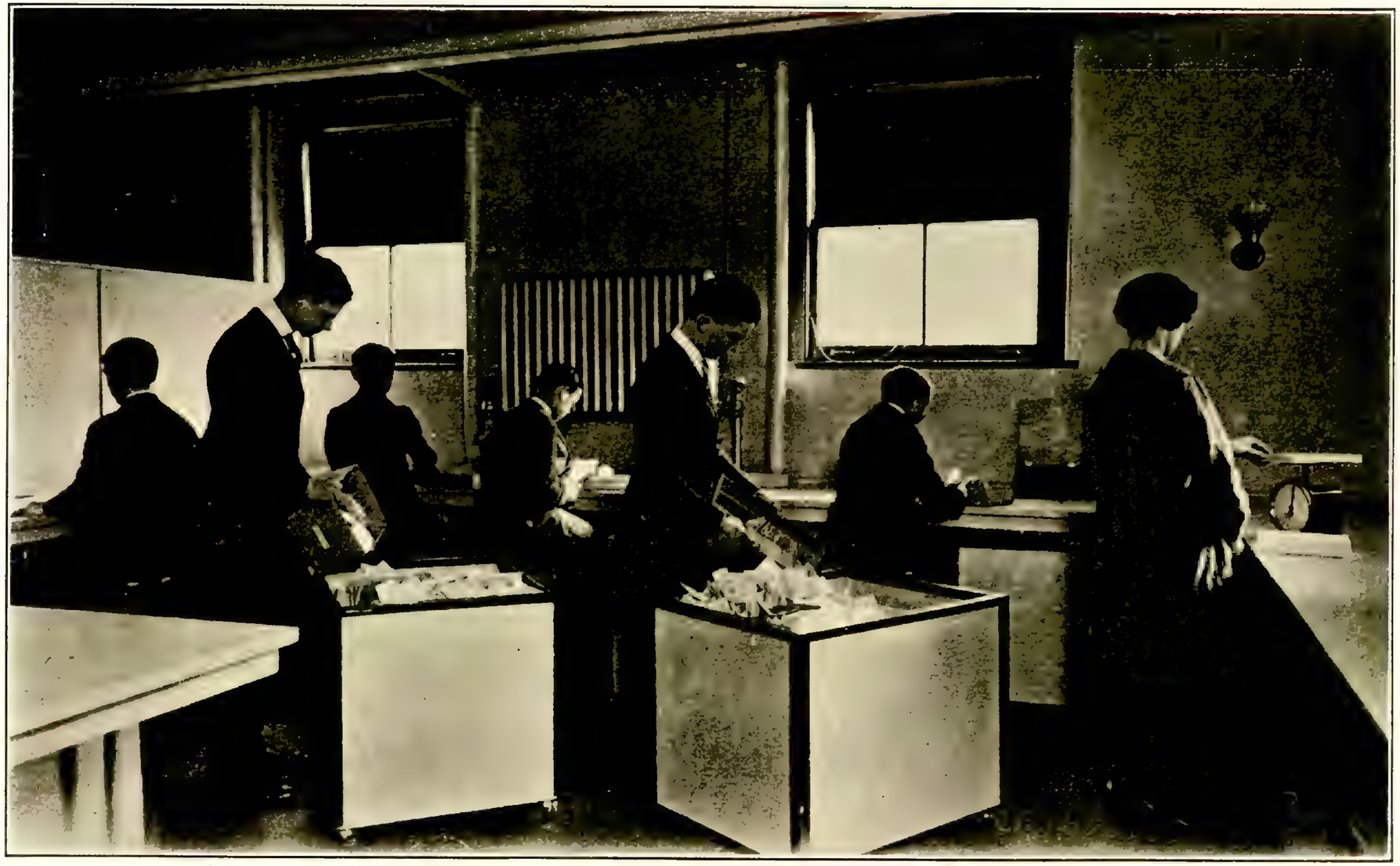

FIG. 8. Preparing packets of seeds for distribution to Brooklyn boys and girls. Nearly 160,000 packets were supplied in 1923.

being extensively used by other departments, increasing their efficiency and saving labor and time.

Scientific Investigation

In October, a paper on " The Melanconis disease of the Butternut " appeared in Phytopathology, summarizing the results of four years' investigations. The scope of this work, as well as the progress of other researches in forest pathology, are more fully outlined in the Report of the Director (pp. 27–28).

Respectfully submitted,
ARTHUR HARMOUNT GRAVES,
Curator of Public Instruction.

REPORT OF THE CURATOR OF ELEMENTARY INSTRUCTION FOR 1923

DR. C. STUART GAGER, DIRECTOR.

Sir: I would like to call to your attention in this eleventh annual report, the salient points in the work of the Department of Elementary Instruction for the year 1923.

October 1, 1923, rounded out ten years of work in elementary instruction. A report of these ten years was made in the form of a Leaflet (Series XI, No. 10) published last October. It is unnecessary for me again to call your attention to the statistics embodied in that Leaflet. In itself it was in the nature of an annual report, but I would like to make this point—that during the entire year of 1923 the Department has come in touch through its various activities with over 230,000 children. This is not an attendance report. At the present time over 90 per cent. of the elementary schools of the borough have some connection with our work. The work of the Department has increased 33⅓ per cent. during the last three years, but there has been no increase in the staff.

Many educational demands have been made upon us this year outside of those of our regular work. On May 4, delegates from all of the troops of the Girl Scouts of the Borough of Brooklyn met at the Brooklyn Botanic Garden. The meeting was held at

the request of Miss Truman, Girl Scout Director of the Borough, and was conducted by the officers of our own Boys and Girls Club. The object was to acquaint the Girl Scouts with the opportunities presented here at the Garden for their work. A number of Girl Scouts joined our outdoor garden as a direct outgrowth of this meeting. The Mineola Home for Cardiac Children asked us again to assist them with their outdoor garden. During the spring Miss Sanders went every two weeks to Bellevue Hospital and gave special nature study lessons to their crippled children. The Montessori Kindergarten Training School of Manhattan requested a course of lessons for their junior and senior students. These were given during February, March, and April. At the same time a similar course was given to the juniors and seniors of Froebel League, another Manhattan kindergarten training school. During the fall, the Midwood School, a new private school in our borough, has come every second Friday for special work. The roof garden at P.S. 21, Manhattan, was made possible through our help. This little garden was a feature of the work done by the children of the ungraded classes in that school. I may state here that among the educational demands made upon the time of the curator was the writing of a chapter in a book planned for children and teachers, by name, the "*Home Educator,*" published by the Foundation Desk Company, Inc., of Chicago; and also a series of seven plant stories for children requested by Professor M. V. O'Shea, of the University of Wisconsin. These stories appeared in the *Junior Home Magazine*.

During the year 1923, the curator has given 293 talks and lectures. This includes both outside lectures and those given at the Botanic Garden to visiting classes.

I should like to bring to your attention certain gifts to the Department which show in themselves unusual interest, such as the one given by the Little Men and Women of '76—a gift of $35 for books for our children's room; also the gift of Mrs. Glentworth Butler of a prize cup to be competed for by the girls of our 1923 outdoor garden. I mention this gift because of the stimulus it gave to the girls of the garden. Milton Hudders, the first secretary of the Boys and Girls Club, presented a set of John Burroughs' books for the children's room. This is

typical of the interest the old boys and girls show for the Brooklyn Botanic Garden. Two other boys sent their checks for a similar purpose, Fred Werner for $25, and Philip Corby for $10.

The Saturday morning classes for boys and girls have been more largely attended and we have had more requests for admission than during any one other year. On December 22, our first children's Christmas party was held in the boys' and girls' own room. It has been impossible before to have a room suitable in which to hold such a gathering. Christmas stories were told by Mrs. Orland E. White, and plants were distributed to the children.

I should like here to refer to another point of contact made this year with the local high schools of the borough brought about through the need of a bookplate for the children's library. The contest for this design was open to the art departments of the Brooklyn high schools. This created a great deal of interest among the schools and the bookplate designs submitted showed not only interest in the theme, but value in themselves. An adequate notice of this contest appeared in the Botanic Garden RECORD of January, 1924, Volume XIII, No. 1, page 22.

The work with visiting classes has been enriched with two more syllabi—one on "Bulbs" and the other on "Little Gardens." We have added to our motion picture equipment two reels—one on "Cotton" and one on "Cocoa." The attendance of visiting classes has increased over that of last year. During 1923 almost twice as many plants were distributed to schools and teachers as were given out during 1922. The work in the distribution of seed has increased nearly one-third this year over the total distribution for 1922.

The educational work in the children's outdoor garden has not remained static. A number of new and interesting outgrowths of that work appeared during the summer of 1923. A good deal of time was given to a private motion picture corporation in working with them to make a moving picture of our work for educational purposes. A Garden paper called *Agricola* was started by the boys and girls and has been written, edited, and published by them every two weeks since its inauguration in early July. More work than ever before was done in connection with special features in the outdoor garden, such as the flower garden, the

rose garden, the types and varieties of shrubs, and the herb garden. This last was started, planted, and cared for by Miss Catherine A. Mullen, a Federal Board student. Every two weeks in the summer the children had an informal entertainment in the flower garden, different sections of the garden taking turns in entertaining the rest of the boys and girls. The Nature Study Department from New York University visited our outdoor garden to study the methods used. As usual, a good many gifts of vegetables and flowers were sent by the boys and girls of the garden to different charitable organizations in this borough. At the fall meeting of their Club the children presented to the Botanic Garden a terra cotta image, in color, for their outdoor garden. The support of a French orphan, carried by our boys and girls for the last five years, was discontinued this year, due to the fact that the boy has become of an age to support himself.

Arrangements were made during this last year for the construction of transparencies for the windows in the Boys and Girls Club room; and for the painting of floral panels for wall spaces previously planned for such a purpose. These pieces of work will be completed in 1924. The gift of a beautiful Italian marble image presented by Miss Alice L. Morse is another feature of beauty for this room. The image represents a little lad saying, "Oh, how happy I am!" The photograph of Mr. Alfred T. White presented by Mrs. Adrian Van Sinderen has been framed and hung, and photographs of Fabre and of Mrs. Anna Botsford Comstock, former Professor of Nature Study at Cornell, are in process of framing. The room gives promise of great beauty.

It might be of interest to you and to the trustees to know that the certificates given by the Garden to a class of boys from P.S. 90 who came here for regular work during school hours were presented to them by Mr. John Winter, Principal of the school, at the time of their graduation. This leads me to state that the work done here by visiting classes is used more and more as a basis for regular classwork by the teachers who come to us.

Respectfully submitted,

ELLEN EDDY SHAW,

Curator of Elementary Instruction.

REPORT ON THE CRYPTOGAMIC HERBARIUM

DR. C. STUART GAGER, DIRECTOR.

Sir: I beg to submit herewith the Annual Report on the Cryptogamic Herbarium for the year 1923.

A total of 2,168 specimens have been added to the Herbarium. The source of these specimens is indicated in the accompanying table.

ACCESSIONS TO THE CRYPTOGAMIC HERBARIUM, 1923

Date	No. of Spec.	From	How Acquired	Remarks
		Algae, Lichens, Liverworts, Mosses		
Feb. 28	13	J. M. Holzinger	Purchased	Mosses—N. America
Apr. 18	173	George H. Conklin	Gift	Hepaticae
Sept. 20	20	Botanic Garden, Cluj, Roumania	Exchange	
Oct. 15	25	J. M. Holzinger	Purchased	Mosses—N. America
Nov. 1	725	W. Migula	Purchased	Krypt. Germ., Aust. et Helvetiae, 29 Fasc.
Total	956			
		Fungi		
Jan. 18	200	E. Bartholomew	Purchased	N. A. Ured. Cent. 28, 29
July 31	30	J. F. Brenckle	Purchased	Fungi Dakotensis, Fasc. 22
Aug. 22	250	H. Sydow	Purchased	Mycotheca Germanica, Fasc. 37, 41
Aug. 22	100	H. Sydow	Purchased	Fungi Exotici. Fasci. 10, 11
Oct. 3	28	Botanic Garden, Cluj, Roumania	Exchange	
Nov. 1	275	W. Migula	Purchased	Krypt. Germ., Aust. et Helvetiae, 11 Fasc.
Dec. 15	370	Office Pathological Collections, U. S. D. A.	Exchange	
	59		Collection	
Total	1,312			

Special note may be made of the addition to the Herbarium of a complete set of the Kryptogamae Germanicae, Austriae et Helvetiae, issued by Doctor W. Migula, Professor at the Sächsen Forst-Academie, Eisenach, Germany. A large collection of fungi, other than rusts and smuts, was received from the Office of

Pathological Collections, U. S. Department of Agriculture.

The failure to provide an herbarium assistant in the Cryptogamic Herbarium in 1923 was a serious handicap. Very little progress was made in mounting and arranging the Bubák collection which was noted in the report for last year, so that this valuable herbarium has not yet been made available for ready examination and comparison of specimens. Further, it was not possible to prepare duplicates of our collection for exchange with other institutions or individuals, except that a few specimens of smuts were sent to Mr. George L. Zundel, Washington State Agricultural College. It is very important that provision be made for an assistant at as early a date as possible so that the Cryptogamic Herbarium may be given proper care. Provision should also be made for additional steel cases for holding the collection as the present ones are overcrowded, to the detriment of the specimens.

Respectfully submitted,

GEORGE M. REED,

Curator of Plant Pathology.

REPORT OF THE LIBRARIAN FOR 1923

DR. C. STUART GAGER, DIRECTOR.

Sir: I have the honor to submit herewith my report as librarian for the year ending December 31, 1923.

In an analysis of the work of the past year, it is gratifying to report definite progress in various phases of the work. However, this progress, in the form of a larger current serial file, to mention one instance only, increases the amount of routine work so that with no more assistance in the department, work of another sort necessarily lags. While our figures for accessions, current serials received, and bindery work exceed those of 1922, the cataloguing of a recent large purchase has not been completed.

Accessions

The 1923 accessions are 1,219 vols., 629 pamphlets and 10,434 parts of publications as compared with 988 vols., 556 pamphlets and 6,033 parts for 1922.

Some of the larger sets acquired during the year were the *Archivos do Museu Nacional do Rio de Janeiro,* 11 vols.; *Atti dell' Istituto Botanico dell' Universita di Pavia,* 11 vols.; Board of Scientific Advice for India, *Annual Report,* 17 vols.; *Bulletin de la Société Botanique de France,* 29 vols.; *Magyar Botanikai Lapok* (Ungarische Botanische Blätter), 17 vols.; *Philosophical Transactions,* of the Royal Society of London, series B, 34 vols.; *Proceedings and Transactions of the Nova Scotian Institute of Science,* Halifax, 29 vols.; *Proceedings of the Biological Society of Washington,* 11 vols.; *Proceedings of the Royal Society of London,* 40 vols.; *Publications of the Carnegie Institution of Washington,* 47 vols.; Rabenhorst's *Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz,* 18 vols.; *Verhandlungen des Botanischen Vereins der Provinz Brandenburg,* 64 vols.

Chief among the rarities purchased with the income from the Benjamin Stuart Gager Memorial Fund may be mentioned Arnoldus De Nova Villa, *Incipit Tractatus De Virtutibus Herbarum,* Vinceciae, 1491. The other additions to our Pre-Linnaean collection, acquired in the same way, were Nicolás Monardes, *Simplicium Medicamentorum Ex Novo Orbe Delatorum . . .,* 1579; Joannes Baptista Porta, *Phytognomonica In Quibus Nova . . .,* 1591; Prosper Alpinus, *Prosperi Alpini De Plantis Aegypti Liber . . .,* 1640; Anselm Boetius De Boot, *Florum, Herbarum . . .,* 1640; Ulyssis Aldrovandus, *Dendrologiae Naturalis . . .,* 1671.

Through the courtesy of the Long Island Historical Society over seventy volumes were donated by Mr. William J. Studwell in memory of Henry A. Studwell, M.D. Included in this gift is the historically interesting volume entitled *Vestiges of the Natural History of Creation,* published anonymously but generally understood to have been written by Robert Chambers.

Periodicals

The library receives currently 709 periodical and serial titles, an increase of 111 over 1922. Exchanges now number 548, and subscriptions 72. Of the 111 new titles, 54 are foreign, and some of these are listed herewith:

Annales des Sciences Naturelles, Botanique, Paris; Beiträge zur Kryptogamenflora der Schweiz, Zurich; Proceedings of the Cambridge Philosophical Society, Biological Sciences, London; La Cellule, Recueil de Cytologie et d'Histologie Générale, Louvain; Bulletin de Vulgarisation des Sciences Naturelles, Organe de la Société Botanique et Entomologique du Gers; Bericht der Oberhessischen Gesellschaft für Natur- und Heilkunde zu Giessen; Journal of Pomology and Horticultural Science, London; Magyar Botanikai Lapok (Ungarische Botanische Blätter), Budapest; Repertorium Specierum Novarum Regni Vegetabilis, Berlin; Boletin de la Sociedad de Estudios Biologicos, Mexico; Roczniki Nauk Rolniczych, Posen; Ochrona Przyrody Organ Panstwowej Komisji Ochrony Przyrody, Krakow; Acta Societatis Botanicorum Poloniae, Warsaw; Journal de la Section de Moscou de la Société Botanique de Russie, Moscow; Mémoires de la Société Vaudoise des Sciences Naturelles, Lausanne; Revista Industrial y Agricola de Tucuman; Atti dell' Istituto Botanico dell' Universita di Pavia; Annali della Regia Scuola Superiore di Agricoltura, Portici; Archivos do Museu Nacional do Rio de Janeiro, Brazil; Berichte über die Verhandlungen der Sächsischen Akademie der Wissenschaften zu Leipzig; Uganda Protectorate, Annual Report and Circular of the Department of Agriculture; Journal, Department of Agriculture, Victoria, Australia; Agricultural Bulletin, Department of Agriculture, Bermuda; Journal, Board of Agriculture, British Guiana; Notes, Royal Botanic Garden, Edinburgh; Report, Botanical Survey of India; Annual Report and Bulletin, Department of Agriculture, Bombay Presidency; Annual Report, Experimental Work of the Bassein Botanical and Agricultural Station, Bombay; Annual Report, Experimental Work of the Ganeshkind Botanical Garden, Bombay; Bulletin, Report, Department of Agriculture, Burma; Memoir, Agricultural Directorate, Ministry of Interior, 'Iraq, Mesopotamia; Annual Report, Director of Forestry, New Zealand; Bulletin des Matières Grasses de l'Institut Colonial de Marseille.

Binding

Three lots of publications were prepared and forwarded to the binder in January, July and September, 497 volumes in all. These were mainly completed volumes of serials and periodicals.

Inter-Library Loans

Requests for the loan of publications were received from several scientific institutions out of the city, as well as from city institutions. Libraries of business firms have also availed themselves of this privilege. Twenty-one volumes were borrowed during the year.

Seventy-four publications were loaned us for the use of our staff by the American Geographical Society, American Museum of Natural History, Brooklyn Museum, Brooklyn Public Library, Columbia University, Cornell University, Library of Congress, Lloyd Library, N. Y. Public Library, and the libraries of the U. S. Dept. of Agriculture and the Bureau of Plant Industry.

Miscellaneous

Thanks is due the N. Y. State Library for forwarding us a case of agricultural experiment station publications among which were found many missing numbers from our shelves.

The library was also successful in securing 337 early numbers of Annual Reports and Bulletins direct from agricultural experiment stations in response to requests for early lacking numbers.

Lists of scientific institutions and government agricultural departments were compiled for future exchanges.

Eighty-three new subjects were added to our reference file. This file includes the source where the information wanted was found, so that repetition of work is eliminated.

To facilitate the use of the library, 160 black letter shelf labels were made for serial titles, agricultural experiment stations and U. S. publications; over 250 guides for the pamphlet collection; and 165 new guides for seed catalogues.

Shelf space in the library is so limited that we were forced to withdraw 350 volumes, and add them to our overflow collection in the downstairs stack room, which now totals 634 volumes.

The Garden library was represented at the New York Library Club, the Annual Convention of the Special Library Association, and at the New York Regional Group of Cataloguers.

For list of donors and gifts, see Appendix 1.

The statistical report follows:

STATISTICAL REPORT ON THE LIBRARY

Accessions

	Volumes	Pamphlets	Parts (Including Periodicals)
Exchange	194	193	4,837
Gift	246	236	4,707
Publication	1	100	300
Purchase	369	100	582
Bindery	409	0	0
Deposit	0	0	8
Total	1,219	629	10,434

Total number of parts of publications added to library during 1923, including current periodicals	10,434
Total number of volumes in the library, December 31, 1922	8,648
Total number of volumes added during 1923	1,219
Total number of volumes in the library, December 31, 1923	9,867
Minus volumes lost as shown by inventory of classified collection completed August, 1922	3
Total number of volumes in the library, December 31, 1923	9,864
Total number of pamphlets in the library, December 31, 1922	5,998
Total number of pamphlets added during 1923	629
Total number of pamphlets in the library, December 31, 1923	6,627
Minus pamphlets lost as shown by inventory of classified collection completed August, 1922	3
Total number of pamphlets in the library, December 31, 1923	6,624
Total number of volumes and pamphlets in library, December 31, 1922	14,646
Total number of volumes and pamphlets added during 1923	1,848
Total number of volumes and pamphlets in library, December 31, 1923	16,494
Minus volumes and pamphlets lost, as shown by inventory of classified collection	6
Total number of volumes and pamphlets in library, December 31, 1923	16,488

Serials, Periodicals, and Exchanges

No title has been included in this list unless a number has been received during 1923.

Subscription	72
Gift	77
Exchange	548
Deposit from Brooklyn Public Library	2
Publication	10
Total	709
Increase	111

Cataloguing

Volumes entered in accession book	1,219
Books, Pamphlets, Serials catalogued	2,924
Duplicates catalogued	2,771
Catalogue cards typewritten	1,414
Shelf List Cards typewritten	694
Pamphlet cards typewritten	688
Current periodical cards typewritten	177
Cards for Catalogue of Duplicates typewritten	269
New typewritten cards filed	3,242
Books, Pamphlets and Serials revised	2,924
Catalogue cards revised	3,242
Torrey Botanical Club Index Cards on file December 31, 1922	31,100
Filed during 1923	1,014
Total number of Torrey Botanical Club Index Cards on file December 31, 1923	32,114
Index Algarum Universalis Cards, December 31, 1922	15,604
Cards received during 1923	0
Total number of printed cards filed during 1923	1,014

Miscellaneous

Number of volumes bound	497
Attendance in library, approximately	8,421
Books loaned to members of staff	1,315
Books loaned to other institutions	21
Books borrowed from other institutions	74
Lantern slides on file December 31, 1922	3,407
Lantern slides accessioned during 1923	458
Total number of lantern slides on file December 31, 1923	3,865
Photographic negatives on file December 31, 1922	4,385
Negatives accessioned during 1923	340
Total number of negatives on file December 31, 1923	4,725

Respectfully submitted,

RAY SIMPSON,

Librarian.

FINANCIAL STATEMENTS FOR 1923

I. Tax Budget Accounts

1360 *Personal Service*

Appropriation	$70,761.00
Expended	70,761.00
Balance, December 31, 1923	$ 0.00

1361 *Other Codes Than Personal Service*

Appropriation	$ 8,803.96
Expended	8,795.71
Unexpended balance, December 31, 1923	$ 8.25

Summary of Tax Budget Accounts

Appropriated by City for maintenance	$79,564.96
Expended	79,556.71
Unexpended balance, December 31, 1923	$ 8.25

II. Private Funds Accounts

1. *Endowment Fund* ($75,500.00). *Restricted in part:*

Income Account:

Income, 1923	$ 4,143.03
Transferred to Special Contributions	4,143.03
Balance, December 31, 1923	$ 0.00

2. *Life Membership Fund* ($5,000.00). *Restricted:*

Income Account:

Balance, January 1, 1923		$ 130.79
Income, 1923		268.10
		$ 398.89
Expended	$ 139.05	
Transferred to Endowment Increment Fund	53.62	
Transferred to Special Contributions	206.22	398.89
Balance, December 31, 1923		$ 0.00

3. *George C. Brackett Library Fund* ($500.00). *Restricted:*

Income Account:

Balance, January 1, 1923		$ 14.11
Income, 1923		27.48
		$ 41.59
Expended	$ 14.83	
Transferred to Endowment Increment Fund	$ 5.49	20.32
Balance, December 31, 1923		$ 21.27

4. *Benjamin Stuart Gager Memorial Fund* ($10,000.00). *Restricted:*

Income Account:		
Balance, January 1, 1923		$ 16.28
Income, 1923		924.24
		$ 940.52
Expended	$ 681.94	
Transferred to Endowment Increment Fund	184.85	866.79
Balance, December 31, 1923		$ 73.73

5. *Martha Woodward Stutzer Memorial Fund* ($5,000.00). *Restricted:*

Income Account:		
Balance, January 1, 1923		$ 128.09
Income, 1923		275.00
		$ 403.09
Expended	$ 340.56	
Transferred to Endowment Increment Fund	55.00	395.56
Balance, December 31, 1923		$ 7.53

6. *Mary Bates Spalding Fund* ($2,000.00). *Restricted:*

Income Account:		
Balance, January 1, 1923		$ 50.50
Income, 1923		94.33
		$ 144.83
Transferred to Endowment Increment Fund		18.86
Balance, December 31, 1923		$ 125.97

7. *Cary Library Fund* ($10,000.00: 1/5 to Brooklyn Botanic Garden). *Restricted:*

Income Account:		
Balance, January 1, 1923		$ 20.47
Income, 1923		110.00
		$ 130.47
Expended	$ 92.70	
Transferred to Endowment Increment Fund	22.00	114.70
Balance, December 31, 1923		$ 15.77

8. *Special Fund (Brooklyn Institute General Endowment Income: Annual Allotment). Restricted:*

Income Account:	
Income, 1923	$ 2,930.00
Transferred to Special Contributions	2,930.00
Balance, December 31, 1923	$ 0.00

9. *Botanic Garden Collections Fund, 1923. Restricted:*		
Transferred from Collections Fund, 1922		$ 573.56
Received from contributions, 1923		7,672.00
		$ 8,245.56
Expended	$ 7,881.47	
Transferred to Special Contributions	209.31	8,090.78
Balance, December 31, 1923		$ 154.78
10. *Sustaining Membership. Restricted:*		
Balance, January 1, 1923		$ 65.82
Received from dues, 1923		350.89
		$ 416.71
Expended	$ 130.02	
Transferred to Endowment Increment Fund	70.18	
Transferred to Special Contributions	216.51	416.71
Balance, December 31, 1923		$ 0.00
11. *Annual Membership. Restricted:*		
Balance, January 1, 1923		$ 133.03
Received from dues, 1923		1,620.00
		$ 1,753.03
Expended	$ 1,361.18	
Transferred to Endowment Increment Fund	324.00	
Transferred to Special Contributions	67.85	1,753.03
Balance, December 31, 1923		$ 0.00
12. *Tuition and Sales. Restricted:*		
Balance, January 1, 1923		$ 1,505.24
Received, 1923:		
(*a*) Tuition	$ 2,867.39	
(*b*) Seed Packets	3,194.71	
(*c*) Incidentals	586.27	6,648.37
		$ 8,153.61
Expended	$ 3,350.98	
Transferred to Endowment Increment Fund	1,296.86	
Transferred to Special Contributions	2,159.11	6,806.95
Balance, December 31, 1923		$ 1,346.66
13. *Special Purposes. Restricted by terms of gift:*		
Special gift for Japanese Garden:		
Received		$ 500.00
Expended		470.52
Balance, December 31, 1923		$ 29.48

Special gift for Children's Room:		
Received		$ 500.00
Expended		438.41
Balance, December 31, 1923		$ 61.59

14. *Special Contributions. (For 1923 only)*

Contribution		$ 118.50
Transferred from Endowment Fund Income Account		4,143.03
Transferred from Special Fund		2,930.00
Transferred from Special Account W		6,953.00
Transferred from Life Membership		206.22
Transferred from Sustaining Membership		216.51
Transferred from Annual Membership		67.85
Transferred from A. Augustus Healy Bequest		430.82
Transferred from Collections Fund		209.31
Transferred from Tuition and Sales		2,159.11
		$17,434.65
Expended		17,434.65
Balance, December 31, 1923		$ 0.00

15. *Special Account W. Restricted:*

Income Account:		
Balance, January 1, 1923		$ 41.10
Income, 1923		12,083.91
		$12,125.01
Expended	$ 2,754.93	
Transferred to Endowment Increment Fund	2,416.78	
Transferred to Special Contributions	6,953.30	12,125.01
Balance, December 31, 1923		$ 0.00

16. *Plant Pathology Research Fund. Restricted:*

Income, 1923	$12,000.00
Expended	11,073.01
Balance, December 31, 1923	$ 926.99

17. *A. Augustus Healy Bequest* ($9,791.67). *Restricted:*

Income Account:		
Income, 1923		$ 538.52
Transferred to Endowment Increment Fund	$ 107.70	
Transferred to Special Contributions	430.82	538.52
Balance, December 31, 1923		$ 0.00

18. *Endowment Increment Fund. Restricted:*		
Income Account:		
Transferred from other accounts, 1923		$ 4,555.34
Interest, 1923		544.71
		$ 5,100.05
Transferred to Principal		5,100.05
Balance, December 31, 1923		$ 0.00
Summary of Private Funds Accounts:		
Balance, January 1, 1923		$ 2,678.99
Income, 1923		51,349.08
		$54,028.07
Expended	$46,164.25	
Transferred to Endowment Increment Principal	5,100.05	
	$51,264.30	
Balance on hand December 31, 1923.	2,763.77	54,028.07

APPENDIX 1

GIFTS RECEIVED DURING 1923

Collections Fund

Anonymous
Mrs. W. A. Andrews
Miss E. Addie Austin
Mr. Frank Babbott
Mr. Frank Bailey
Mr. David Boody
Dr. and Mrs. Glentworth R. Butler
Mrs. E. R. Coker
Mr. William C. Courtney
Mr. Walter H. Crittenden
Miss Alice C. Crowell
Mr. Otto Ebel
Mr. Walter Ebel
Mr. Gates D. Fahnestock
Mrs. Lewis W. Francis
Mr. John W. Frothingham
Mrs. A. Augustus Healy
Mr. and Mrs. James M. Hills
Mrs. John Hills
Miss Frances T. Ingraham
Mr. A. W. Jenkins
Mrs. A. S. Kirkman
Miss Julia W. Latimer
Miss Hilda Loines
Mrs. John Bradley Lord
Mr. William G. Low
Mr. Horace J. Morse
Miss Martha W. Olcott
Mr. and Mrs. James H. Post
Mr. George D. Pratt
Mr. William A. Putnam
Mrs. William A. Putnam
Mr. W. B. Seymour
Mr. F. H. Sloan
Mr. Harold Somers
Mrs. Mary Bates Spalding
Dr. E. H. Squibb
Mr. Herman Stutzer
Mrs. Mary Van Norden
Mr. Alex M. White
Miss F. E. White
Miss H. H. White
Mr. Harold T. White
Mrs. Fred Willenbrock
Miss Mary B. Woodward

Living Plants

Miss E. Addie Austin (8)
Mr. Frank Bailey (18)
Charleston Museum (2)
Conard & Jones Co. (480)
Mr. Martin C. Ebel (6 cuttings)
Mr. Bertrand H. Farr (45)
Miss Grace Sturtevant
(Glen Road Iris Gardens) (8)
Mrs. Edward Harding (13)
Mr. L. M. Johnston (1)
Dr. Cyrus A. King (1)
The Movilla Gardens (4)
Mr. O. M. Pudor (12)
Mr. Otto Richardson (1)
Mr. Alexander Sprunt, Jr.
(1 box of *Tillandsia usneoides*)

Seeds

Mr. H. Bird (1)
Dr. J. S. Chamberlain (2)
Mr. Charles C. Deam (1)
Miss Helen E. Graves (8)
Mr. John L. Macumber (1)
Dr. E. Vietor (1)
Miss Caroline Young (1)

Phanerogamic Herbarium

American Museum of Natural History, collected by the Whitney South Sea Expedition.
279 specimens from Polynesia.

Mr. Harry H. Andessy, 142 Lefferts Avenue, Brooklyn.
Ficus diversifolia (cultivated).

Dr. Ralph C. Benedict, 322 East 19th Street, Brooklyn.
11 specimens of cultivated ferns.

Mr. H. M. Edwards, 827 Prospect Place, Brooklyn.
Rudbeckia hirta, with ray florets ascidia.

Dr. C. Stuart Gager, Brooklyn Botanic Garden.
Fragaria, showing propagation by runners.

Dr. Arthur Harmount Graves, Brooklyn Botanic Garden.
131 specimens, most of which were collected in Wales.

Mr. John McCallum, Brooklyn Botanic Garden.
5 specimens of *Euphorbia marginata* (cultivated).

Dr. John L. Macumber, 1240 Dean Street, Brooklyn.
Xanthoxylum clava-Herculis, collected near Wilmington, N. C.

Mr. Papazian, Brooklyn, N. Y.
3 specimens of fruits from Constantinople.

Mr. R. A. Pope, Anchorage, Alaska.
285 specimens collected in Alaska.

Mr. Frank Stoll, Brooklyn Botanic Garden.
3 specimens, one of which was collected at Bridgeton, Maine, and two from Kissena Park, L. I.

Mrs. W. L. Van Sinderen, 133 Henry Street, Brooklyn.
Helleborus niger, collected at Auburn, New York.

Dr. E. Vietor, 124 Cambridge Place, Brooklyn.
Acer circinatum, collected in Milwaukee, Wis.

Cryptogamic Herbarium

Mr. George H. Conklin, Superior, Wisconsin.

173 specimens of hepaticae, to be added to the Annie Morrill Smith Herbarium of mosses and hepaticae.

Library

Books

American Scenic and Historic Preservation Society... 1
Mrs. F. B. Arvine..... 1
Mr. Frank Bailey..... 4
Miss F. C. Berry..... 1
Miss L. M. Brewster..... 1
Miss Philura Brower..... 1
Mr. and Mrs. Louis Buhle... 1
Mrs. Margaret Burdick..... 1
Carnegie Institution of Washington 37
Mr. Philip Corby..... 3
Miss Lois Davis..... 1
M. Henri Dehérain..... 1
Mrs. John Delafield..... 3
Miss B. D. Donegan..... 1
Mr. Walter Euler..... 2
Mr. James Faris..... 2
Mr. Montague Free..... 1
Dr. C. Stuart Gager..... 17
Miss Prudence Gager..... 2
Miss Henrietta Garde..... 1
Miss M. S. Gibbs..... 1
Miss Anne M. Gissel..... 6
Dr. A. H. Graves..... 1
Dr. Alfred Gundersen..... 1
Miss Florence Hall..... 1
Mr. James Hall..... 2
Miss Elsie Hammond..... 1
Miss M. Hickok..... 1
Miss Rowena Hildreth..... 1
Mrs. C. E. Hill..... 1
Mr. Milton Hudders..... 22
Mrs. Alice Earle Hyde..... 3
Miss Thekla Jung..... 3
Miss Isabel Kline..... 1
Little Men and Women of 1776 18
Miss Blanche McHale..... 1
Miss C. Mullen..... 1
Miss D. I. Neff..... 1
N. Y. (S.) Conservation Commission 2
Miss Anna Ohlander..... 1
Miss W. H. Peckham..... 1
Dr. G. M. Reed..... 1
Miss E. R. Sanders..... 1
Mr. John Schmacke..... 1
Miss Ellen Eddy Shaw..... 3
Miss Ray Simpson..... 4
Mr. Edward Everett Steeves. 1
Mr. Frank Stoll..... 2
Mr. William J. Studwell in memory of Henry A. Studwell, M.D..... 71
Mr. Norman Taylor..... 1
Mr. Fred Werner..... 5
Miss Margaret White..... 1
Mrs. Roy Young..... 3

Total 246

Pamphlets

Dr. R. C. Benedict..... 1
Mr. M. M. Brooks..... 5
Carnegie Institution of Washington 6
Carnegie Institution of Washington, Dept. of Genetics 11
Mr. W. T. Councilman..... 1
Prof. John Davids..... 1
M. Henri Dehérain..... 1
Dr. O. A. Farwell..... 3
Mr. Fabio Frassetto..... 2
Mr. Montague Free..... 3
Dr. C. Stuart Gager..... 77
Dr. A. H. Graves..... 5
Mr. N. M. Grier..... 2

Mr. B. B. Higgins	4
Dr. Charles Janet	2
Dr. Aniela Koslowska	33
Dr. Michael Levine	7
Dr. Francis E. Lloyd	14
Dr. E. D. Merrill	29
Dr. Thomas Hunt Morgan	8
Mulford Biological Exploration	4
N. Y. Botanical Garden	4
Mr. G. H. Peterson	1
Prof. F. L. Stevens	5
Mr. Wm. J. Studwell in memory of Henry A. Studwell, M.D	3
Dr. Dezydery Szymkiewicz	3
Yale School of Forestry	1
Total	236

Parts

(Exclusive of U. S. Government Publications)

American Social Hygiene Association	1
Dr. Oakes Ames	2
Dr. L. H. Bailey	1
Brooklyn Museum Library	4
Carnegie Institution of Washington	1
Mr. James Faris	40
Mr. Montague Free	24
Dr. C. Stuart Gager	233
Garden Club of America	5
Dr. A. H. Graves	11
Journal of Pomology and Horticultural Science	1
Dr. C. G. Lloyd	1
Louisiana Engineering Society	1
Mr. Robert Lovdahl	44
Dr. Kingo Miyabe and Dr. Yushun Kudo	3
Mulford Biological Exploration	2
National Conference on State Parks	1
National Research Council	1
New England Federation of Natural History Societies	2
New York (City) Department of Health	56
New York (State) Library	3,368
New York Academy of Sciences	25
New York Botanical Garden	1
New York Horticultural Society	1
Mr. George D. Pratt	19
School Garden Association of New York	5
Mrs. A. M. Smith	3
Société Botanique de Pologne	2
Tree Talk Publishing Company	1
The Misses White	3
Dr. O. E. White	1
Wild Flower Preservation Society	8
Woman's National Farm and Garden Association	3
Total	3,874

Portraits

Dr. Oakes Ames	1
Dr. E. A. Bessey	1
Dr. C. Stuart Gager	6
National Conference on State Parks Committee	1
Dr. Erwin F. Smith	1
Total	10

Autograph

Mr. J. Thomson Willing: One Autograph Letter, Signed, of Alexander von Humboldt.

Photographs and Negatives

V. L. Van Horne:

Negatives	5
Photoprints	11

Miscellaneous

Miss E. Addie Austin, 1 Terrarium.

To the Department of Elementary Instruction

Adelman, Miss Gertrude, $1 for books for the children's library.
Arvine, Mrs. F. B., $3 for books for the children's library.
Bailey, Mrs. Henry, Roses for the children's memory garden.
Boys and Girls Club, One image for the children's flower garden.
Butler, Mrs. Glentworth R., One prize cup to be competed for by the girls of the 1923 outdoor garden.
B5 (Botanic Garden Teachers' Class), Andirons and fireplace implements for the children's room.
Comstock, Mrs. A. B., One photograph of herself for the children's room.
Corby, Mr. Philip, $10 for books for the children's library.
Delafield, Mrs. John, $5 for books for the children's library.
Euler, Mr. Walter, $5 for books for the children's library.
Gager, Mrs. C. Stuart, One vase for the children's room.
Hall, Mr. James, $10 for books for the children's library.
Hickok, Miss Maude L., One watering can for use in the children's room.
Hudders, Mr. Milton, $33 for books for the children's library.
Hughes, Mrs. A. E., Roses for the children's memory garden.
Hyde, Mrs. Clarence P., Subscription to the *Nature Magazine* for the children's library.
Jung, Miss Thekla, $5 for books for the children's library.
Kline, Miss Isabell, $5 for books for the children's library.
Little Men and Women of '76, $35 for books for the children's library.
Long, Mr. Leo, Roses for the children's memory garden.
Midas, Mrs. J. and Jeanette, $1.50 for books for the children's library.
Morse, Miss Alice L., One statue and pedestal for the children's room.
Pratt, Mr. George D., $500 for the children's room.
Scholz, Misses Ethel and Gertrude, $1 for books for the children's library.
Scollay, Mr. John A., Six maps of the Borough of Brooklyn.
Shaw, Miss Agnes M., One picking basket for the children's flower garden.
Shaw, Miss Ellen Eddy, One aquarium for the children's room.
Somer, Miss Ruth, Roses for the rose-arch.
Steeves, Mr. Edward, $5 for books for the children's library.
Van Sinderen, Mrs. Adrian, One photograph of Mr. Alfred T. White for the children's room.
Werner, Mr. Fred, $25 for books for the children's library.
Whitmarsh, Mrs. J. C., $1 for books for the children's library.
Woman's Auxiliary of the Brooklyn Botanic Garden, Six stereoscopes for the children's room: six had lenses for the children's room.

Note.—Numerous gifts of books, and books for the children's library purchased with gifts of money acknowledged above, are listed in the Report of the Librarian (pp. 84–85).

Miscellaneous

Anonymous, for improvement of Japanese Garden, $500.
Blum, Mrs. E. C., Brooklyn, N. Y., 1 Tea kettle (nickel over copper).
Lacey, Miss Maude, Brooklyn, N. Y., 3 Gold fish.
Shaw, Miss Ellen Eddy, and Simpson, Miss Ray, Brooklyn Botanic Garden, 1 Centerpiece for tea table.
Van Sinderen, Mrs. W. L., Brooklyn, N. Y., 1 Jinrickisha.
Wiemuth, Mr. Charles H., Brooklyn, N. Y., 50 Flower pots.

APPENDIX 2

PUBLICATIONS OF MEMBERS OF STAFF DURING 1923

Benedict, R. C.

—— What we know about Boston ferns; What Boston fern is best? Articles in *Florists' Exchange*. The titles are as follows:

X. A further discussion of standards. Jan 6.
XII. The opinions of some growers. Feb. 10.

—— Progress of the Fern Society's program for wild plant protection. *Amer. Fern Jour.* **13**: 18–22. Jan.–Mar.

—— Which Boston fern is best? Prospectus of an experiment to answer this question. *Jour. of Heredity* **13**: 255–263. (June, 1922) Issued Feb. 15.

—— The Mosquito fern. *Amer. Fern Jour.* **13**: 48–52. Apr.–Je.

—— Wild plant conservation in Connecticut, a suburban state. *Amer. Fern Jour.* **13**: 56–59. Apr.–Je. (Reprinted as *Brooklyn Bot. Gard. Leaflets* **XI** [5]. May 30).

—— Notes on the program for wild plant protection. *Amer. Fern Jour.* **13**: 59–60. Apr.–Je.

—— Why study ferns? *Nature Study Rev.* **19**: 185–186. May.

—— Will florists aid to preserve the wild flowers? *Gard. Chron. of America* **27**: 155. June.

—— New bud sports in Nephrolepis. *Brooklyn Bot. Gard. Contr.* No. 32. June. (Reprinted from *Genetics* **8**: 75–95. Jan.)

—— Artificial varieties under natural conditions. Can the bud sports of the Boston fern thrive under conditions of natural selection? *Jour. of Heredity* **14**: 115–116. June.

—— Game laws for the conservation of wild plants. *Science* **58**: 39–41. July 20.

—— More fern material used by florists. *Amer. Fern Jour.* **13**: 96–97. July–Sept.

—— Some botanic garden material for high school work. *Torreya* **23**: 86–88. Sept.

Faris, James A.

—— Anthracnose of the Boston fern. *Mycologia* **15**: 89–95. 2 pl. March.

—— El Mosaico en la Cana de Azucar. *Revista de Agricultura* (Santo Domingo) **17**: 73–76, 90–95, 105–108, 129–133, 145–148. Nov., Dec. 1922, Jan., March, April, 1923.

—— Enfermedades de los productos de valor Economico. *Revista de Agricultura* (Santo Domingo) **17**: 161–168, 177–187, May, June.

Free, Montague

—— The Rock Garden. *Brooklyn Bot. Gard. Leaflets* **XI** [6]. June 13.

Gager, C. Stuart

—— A proposal for wild plant conservation. *Science* **52**: 52–54. Jan. 12.

—— Seeds from Pharaoh's tomb, *N. Y. Sun*. April 27.

—— A Long Island federation of Garden Clubs. *Gard. Bull.* **2**: 1 and 9. Spring, 1923.

—— Twelfth annual report of the Brooklyn Botanic Garden, 1922. Report of the director. *Brooklyn Bot. Gard. Rec.* **12**: 25–50. April.

—— The first "botanic" garden in Brooklyn: Supplementary note. *Brooklyn Bot. Gard. Rec.* **11**: 119–125. Oct.

Graves, Arthur Harmount

—— Report of the Curator of Public Instruction for 1922. *Brooklyn Bot. Gard. Record* **12**: 57–65. April.

——- Some September flowers at the Garden. *Brooklyn Bot. Gard. Leaflets* **XI** [7]. September 19.

—— The Melanconis disease of the butternut (Juglans cinerea L.). *Phytopathology* **13**: 411–435. (October), and *Brooklyn Bot. Gard. Contributions* No. 31.

—— 113 newspaper articles relating to the Brooklyn Botanic Garden.

—— 5 abstracts of botanical papers for Botanical Abstracts, Vol. 12.

Gundersen, Alfred

—— Evolution in Flowering Plants. *Brooklyn Bot. Gard. Leaflets* **XI** [9]. Oct. 17.

Reed, George M.

—— Louis Pasteur—*Brooylyn Bot. Gard. Leaflets* **XI** [3, 4]. May 2.

—— Varietal Resistance and Susceptibility of Sorghums to Sphacelotheca Sorghi (Link) Clint. and Sphacelotheca cruenta (Kühn) Potter. *Mycologia* **15**: 132–143. May 1923.

—— Sorghum Smuts and their relations to Sorghums (Abstract). *Torreya* **23**: 55–56. May–June.

Shaw, Ellen Eddy

—— The tenth annual garden exhibit for Brooklyn boys and girls. *Brooklyn Bot. Gard. Leaflets* **XI** [2]. April 18.

—— Report of the Curator of Elementary Instruction for 1922. *Brooklyn Bot. Gard. Rec.* **12**: 67–71. April.

—— Children's garden work an aid to good citizenship. *The Church School* **4**: 374–375. May.

—— The children's garden at the Brooklyn Botanic Garden. *Natl. Plant, Flower and Fruit Guild Mag.* **12**: 3–4. May.

—— Peter and the garden zoo. *Junior Home Mag.* **4**: 9. July.

—— The stately pines. *The Educator-Jour.* **23**: 595. August.

—— Silk making from green leaves. *Junior Home Mag.* **4**: 9. August.

—— Peter takes a trip to an aviation field. *Junior Home Mag.* **4**: 9. September.
—— How Peter was shot in the woods. *Junior Home Mag.* **4**: 9. October.
—— Ten years of work in elementary education at the Brooklyn Botanic Garden. *Brooklyn Bot. Gard. Leaflets* **XI** [10]. October 31.
—— A Thanksgiving fruit basket. *Junior Home Mag.* **4**: 9. November.
—— Peter and the talking pines. *Junior Home Mag.* **4**: 9. December.
—— Nature work of all kinds. (A chapter in *The Home Educator.*) December.
—— Two *Syllabi* on "Bulbs" and "Little Gardens" for children's classes.

Simpson, Ray

—— Report of the Librarian for 1922. *Brooklyn Bot. Gard. Record* **12**: 71–80. April.

Taylor, N.

—— N. L. Britton and J. N. Rose. The Cactaceae. *Science* **57**: *272–273*. March.
—— Report of the Curator of Plants and Plantations for 1922. *Brooklyn Bot. Gard. Record* **12**: 50–57. April.
—— J. C. Willis. Age and Area. Literary Review, *New York Evening Post.* June. ?
—— The Vegetation of Long Island. Pt. I. The Vegetation of Montauk. *Brooklyn Bot. Gard. Memoirs* **2**: 1–107. June.

White, Orland E.

—— Numerous abstracts of botanical papers. Genetics section of Botanical Abstracts.
—— Gregor Mendel. Pioneer investigator of the laws of heredity. *Brooklyn Bot. Gard. Leaflets,* **XI** [1]. April 4.
—— El monte. *Brooklyn Bot. Gard. Leaflets,* **XI** [8]. October 3.

APPENDIX 3

TALKS, PUBLIC LECTURES, ADDRESSES, AND PAPERS GIVEN BY MEMBERS OF STAFF DURING 1923

By the Director of the Garden:

Jan. 19. *What the Brooklyn Botanic Garden means to Brooklyn and Greater New York.* Branch Alliance of the Second Unitarian Society, Second Unitarian Church, Brooklyn.

Jan. 27. *Evolution and religion.* Brooklyn Institute of Arts and Sciences, Academy of Music Building, Brooklyn.

Feb. 1. *The civic value of the Brooklyn Botanic Garden.* Society of Old Brooklynites, Surrogates Court, Brooklyn.

Mar. 2. *Evolution and religion.* Men's Club, Reformed Dutch Church of the Town of Flatbush, Brooklyn.

June 3. *Evolution.* Public lecture, New York Botanical Garden.

July 10. *Evolution.* Tuesday Evening Psychology Center, Manhattan.

Nov. 22. *Science and religion.* Men's Club, M. E. Church, Amityville, L. I.

Nov. 24. *How botanical books are made.* Round Table of Brooklyn Botanic Garden Boys Club.

Dec. 28. *The value of a botanic garden to the local community.* Ohio Botanic Garden Society, Cincinnati.

By the Curator of Plants:

March 7. *The proposed Hempstead Plains Reservation.* Community Club, Garden City.

April 5. *Preservation of native wild flowers.* Springfield Garden Club.

April 23. *National Garden Week Address.* Hempstead High School.

May 8. *Preservation of street trees and city gardens.* Clinton Avenue Association.

June 27. *Preservation of native wild flowers.* Onteora Garden Club.

August 26. *The vegetation of Montauk.* New York Botanical Garden.

December 11. *The vegetation of Montauk.* Torrey Botanical Club.

By the Curator of Plant Breeding:

April 7. *Economic plants of the Bolivian Indians.* Pennsylvania Botanical Society at the University of Pennsylvania.

April 19. *Gregor Mendel.* Brooklyn Botanic Garden.

May 2. *The hybridization of plants.* Bedford Hills Garden Club.

Oct. 17. *Indians and Indian plants.* The Walden School.

Oct. 22. *Mendel's laws, and plant breeding.* Biology class of Manual Training High School, at the Brooklyn Botanic Garden.

Dec. 1. *Plants and the South American wilderness.* Brooklyn Botanic Garden Boys' Club. At the Garden.

Dec. 7. *Mendel and the laws of plant breeding.* Biology class of Manual Training High School, at the Brooklyn Botanic Garden.

Dec. 14. *The art and laws of plant breeding.* Biology class of Manual Training High School, at the Brooklyn Botanic Garden.

By the Curator of Plant Pathology:

Feb. 28. *Sorghum smuts and their relations to sorghums.* Torrey Botanical Club.

Apr. 20. *Louis Pasteur.* Brooklyn Botanic Garden.

Apr. 29. *Pasteur and the founding of bacteriology.* New York Botanical Garden.

June 19. *Pasteur and the founding of bacteriology.* Tuesday Evening Psychology Club.

Sept. 23. *The story of wheat.* New York Botanical Garden.

Nov. 9. *The story of wheat.* Brooklyn Botanic Garden.

By the Curator of Public Instruction:

Jan. 31. *The Melanconis disease of the butternut.* Torrey Botanical Club, New York Botanical Garden.

Apr. 10. *Arbor Day.* Manual Training High School.

May 31. *The chestnut bark disease.* Boys' High School, Heyward Annex.

Oct. 5. *The life of the plant.* Public lecture, Brooklyn Botanic Garden.

Nov. 19. *Things in general and the Brooklyn Botanic Garden.* Manual Training High School Annex.

Nov. 20. *The civic value of trees.* Flatbush Chamber of Commerce.

Dec. 4. *The conservation of wild flowers.* Bushwick High School.

By the Curator of Elementary Instruction:

January 3. *The plant world and what it means to man.* Bushwick High School.

January 22. *Pedagogical basis of children's garden work at the Brooklyn Botanic Garden.* Professional Study Club of Model Teachers, Maxwell Training School.

January 23. *The value of nature experiences as a preparation for the Easter festival.* St. Ann's Parish House.

January 25. *Graduation address.* P. S. 47.

January 29. *The Brooklyn Botanic Garden: its work for boys and girls.* Parents' Association, P. S. 41.

March 8. *Backyard gardens.* P. S. 171, Mothers' Club.

March 9. *Gardens for boys and girls.* P. S. 14.

March 12. *The ethical value of garden work for children.* Twentieth Century Club, Queens.

March 13. *Children's activities of the Brooklyn Botanic Garden.* Parents' Association, P. S. 93.

March 17. *Plant products of South America.* Little Men and Women of '76, at the Brooklyn Botanic Garden.

March 20. *The plant world.* Girl's Commercial High School Annex, P. S. 129.

April 11. *Soil.* Staten Island Institute of Arts and Sciences.

April 18. *What the Brooklyn Botanic Garden offers to the children of Brooklyn.* The Flatbush School.

April 19. *Memorial service for kindergarten teacher.* P. S. 97, Queens.

April 20. *Spring nature study.* Community Hospital, New York.

April 21. *Gardens and their meaning.* New York Congregational Home for the Aged.

April 23. *How garden work for children helps make good citizens.* New York State Federation of Women's Club at Pouch Mansion.

April 24. *The plant world,* First Assembly. *A garden for your school,* Second Assembly. *Flower and vegetable gardens for boys and girls,* Third Assembly, P. S. 182.

April 26. *Different phases of the children's work at the Botanic Garden.* Mothers' Club, P. S. 55, at the Garden.

April 27. *Arbor Day address.* P. S. 139.

May 3. *What the plant world means to us,* First Assembly. *What the Brooklyn Botanic Garden does for boys and girls,* Second Assembly, P. S. 141.

May 5. *Children's gardens.* Long Island Federation of Garden Clubs, Flushing.

May 9. *Sowing seed for children.* Essex County Council of Parent-Teacher Associations, Columbia High School, South Orange, N. J.

May 10. *Garden work and its educational value.* Adelphi Academy.

May 16. *What the Brooklyn Botanic Garden does for boys and girls.* Mothers' Club, P. S. 139, at the Garden.

May 17. *Children's activities at the Brooklyn Botanic Garden.* Mothers' Club, P. S. 69, at the Garden.

May 23. *Children's activities at the Brooklyn Botanic Garden.* Mothers' Club, P. S. 106, at the Botanic Garden.

May 23. *Graduation address.* Community Hospital, New York.

May 24. *The work of the Brooklyn Botanic Garden with children.* Mothers' Club, P. S. 3, at the Garden.

May 25. *What the Brooklyn Botanic Garden does for boys and girls.* Long Island Federation of Women's Clubs, at the Garden.

June 12. *The world we live in.* Manual Training High School Annex.

June 14. *What plants teach us.* P. S. 127, Manhattan.
June 20. *Little gardens.* P. S. 41.
June 22. *Graduation address.* P. S. 143.
June 22. *Graduation address.* P. S. 181.
September 13. *Seashore gardens.* Asharoken Beach Garden Club.
October 16. *Work for children at the Brooklyn Botanic Garden.* Parents' League of Brooklyn, at the Garden.
October 17. *Fall wild flowers.* Mothers' Club, P. S. 42, at the Garden.
October 25. *House plants.* Mothers' Clubs of Alice E. Fitts Kindergarten and Elizabeth Barrett Browning Memorial Kindergarten.
October 27. *Nature's wonders.* Victory Memorial Hospital.
October 30. *What garden work means in the life of a child.* National Plant, Flower and Fruit Guild.
November 1. *Ten years' progress at the Brooklyn Botanic Garden.* Mothers' Club, P. S. 66, Queens.
November 2. *Ten years of garden work with Brooklyn boys and girls.* Brooklyn Botanic Garden.
November 8. *House plants.* Mothers' Club, P. S. 20.
November 20. *Interesting and useful plants.* P. S. 165.
November 23. *Interesting and useful plants.* P. S. 144.
November 27. *Children's activities at the Brooklyn Botanic Garden.* Park Slope Congregational Church.
December 20. *Christmas greens.* Mothers' Club, P. S. 158.
December 21. *Christmas greens.* P. S. 36.

By the Associate Curator of Plants:

Apr. 25. *The systematic position of the Caryophyllaceae and the Frankeniaceae.* Torrey Botanical Club, at the N. Y. Botanical Garden.
Oct. 26. *The evolution of flowers.* Brooklyn Botanic Garden.
Dec. 31. *Placentation and the classification of Dicotyledons.* Before the Systematic Section, Botanical Society of America, in Cincinnati.

By Instructors in the Department of Elementary Instruction:

May 9. *The children's work at the Brooklyn Botanic Garden.* Mothers' Club, P. S. 70, at the Garden, Miss Sanders, Instructor.

By the Resident Investigator:

May 23. *Game laws for ferns and wild flowers.* Joint meeting of Wild Flower Preservation Society of America, New York Bird and Tree Club, and American Fern Society, Brooklyn Botanic Garden.

Dec. 4. *Evolution of ferns.* Stuyvesant High School Biology Club, New York.

Nov. 17. *Ferns.* Public lecture, New York Botanical Garden.

Dec. 4. *Evolution of Ferns.* Stuyvesant High School Biology Club, New York.

By the Horticulturist and Head Gardener:

Feb. 1. *Alpine and rock gardens.* North Shore Garden Club, Boston, Mass.

Apr. 4. *Rock gardens.* Tuxedo Horticultural Society, Tuxedo, N. Y.

July 15. *A garden pilgrimage in England.* New York Botanical Garden.

Oct. 1. *Native plants for the garden.* Lenox Garden Club, Lenox, Mass.

Oct. 24. *Rock gardens.* Plainfield Garden Club, Plainfield, N. J.

Dec. 13. *Alpine and rock gardens.* Horticultural Society of New York, American Museum of Natural History, N. Y.

By the Registrar and Custodian:

April 3. *Trees as required for merit badges.* Brooklyn Scoutmasters' School, Academy of Music, Brooklyn, N. Y.

April 9. *Gardening.* Upland Civic Association of Jamaica. Jamaica Training School, Jamaica, L. I.

APPENDIX 4

REPORT ON BROOKLYN BOTANIC GARDEN PUBLICATIONS 1923

American Journal of Botany.—Official organ of the Botanical Society of America. Monthly except August and September. The ten issues for 1923 comprise Volume X, with 59 articles on all phases of botany, 576 pages, 39 plates, and 59 text-figures. The circulation as of November 31 (the close of the fiscal year for the *Journal*) was 1,140. This is one of the largest circulations of any botanical journal published devoted solely to publishing the results of research. Prof. C. E. Allen, University of Wisconsin, continued as editor-in-chief, with an editorial board of seven.

Ecology.—Official organ of the Ecological Society of America. Quarterly. Volume IV, 1923, contains 36 contributions, besides numerous reviews, proceedings, abstracts of zoological literature, notes and comment. There were 439 pages with 95 text-figures. The circulation, as of December, 1922, was 877. Major Barrington Moore was continued as editor-in-chief with an editorial board of fifteen.

Genetics.—Bi-monthly. One issue of volume seven (1922) and five issues of volume eight (1923) appeared in 1923, comprising 34 articles, 575 pages, 124 text-figures, and 8 plates. This journal is published by the Garden in cooperation with the Editorial Board of *Genetics,* with Prof. George H. Shull, Princeton University, as managing editor.

Record.—Administrative quarterly. The four numbers published in 1923 constitute volume XII, with 136 pages, and 14 halftone illustrations. The January number comprises the *Prospectus,* and the April number the *Annual Report* of the Garden. The director of the Garden is the editor.

Memoirs.—Period of issue irregular. Volume II, The vegetation of Long Island; Part I, The vegetation of Montauk, by Norman Taylor, curator of plants and plantations, comprises 108 pages and 30 text-figures, and was published June 11, 1923.

Contributions.—Numbers 29–32 were published during the year. Each number comprises a reprint of one paper.

Leaflets.—Series XI comprised ten numbers, of which numbers 1–6 appeared during April to June, and numbers 7–10 in September and October. The popularity and circulation of this little publication increase each year.

Seed List.—The tenth annual *List of Seeds* for exchange with other botanic gardens was published in December. Over 940 species and varieties were listed.

The total number of published pages devoted to the results of botanical research was 1,741, as against 1,375 pages published in 1922.

APPENDIX 5

MEETINGS OF ORGANIZATIONS AND SOCIETIES AT THE GARDEN, 1923

March 17. Little Men and Women of '76, Children of the American Revolution.....
April 26. Mothers' Club, P. S. 55.....
April 27. The Federated Garden Clubs of Long Island (Organization meeting).....
May 9. Mothers' Club, P. S. 70.....
May 16. Mothers' Club, P. S. 139.....
May 18. Flatbush Garden League.....
May 23. Joint meeting, Torrey Botanical Club, New York Bird and Tree Club, American Fern Society, and the Wild Flower Preservation Society of America.....
May 25. Long Island Council of Women's Clubs.....
May 28. Brooklyn Y. M. C. A. executive staff.....
June 2. Society of Old Brooklynites.....
October 16. Parents' League of Brooklyn.....
October 16. Department of Botany, Brooklyn Institute of Arts and Sciences.....
October 18. Mothers' Club, P. S. 42.....
October 19. Flatbush Garden League.....
November 30. Camp Sokokis.....

APPENDIX 6

FIELD TRIPS

By the Curator of Public Instruction:

August 25. Torrey Botanical Club. Staten Island.

October 13. Botanical Department, Brooklyn Institute of Arts and Sciences. Staten Island.

By the Associate Curator of Plants:

October 21. Torrey Botanical Club. Valley Stream, L. I.

By the Registrar and Custodian:

April 28. Department of Botany, Brooklyn Institute. Neshanic, N. J.

May 26. Annual session, National Council Woodcraft League. Greenwich, Conn.

June 9. Nassau County Council Training Class for Scoutmasters, Whitman Estate. Westbury, L. I.

October 27. Department of Botany, Brooklyn Institute. Kissena Park, near Flushing, L. I.

APPENDIX 7

REPORT ON PHOTOGRAPHIC WORK, 1923

Negatives on file December 31, 1923		4,385
Negatives accessioned during 1923		340
Total negatives on file Dec. 31, 1923		4,725
Lantern slides on file December 31, 1922		3,407
Lantern slides accessioned during 1923		458
Total lantern slides on file Dec. 31, 1923		3,865
Prints on file December 31, 1922		711
Prints made during 1923	1,619	
Used or distributed	1,279	
Filed		340
Total prints on file Dec. 31, 1923		1,051
Enlargements made		74

APPENDIX 8

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Amount subscribed	$27,850.72
Interest received	228.92
Total Income	28,079.64
Expended	24,189.79
Balance	$ 3,889.85

The unexpended balance was turned over to the Brooklyn Botanic Garden as a permanent fund to be invested, the income to be used, as needed, for the upkeep of the memorial and its immediate surroundings.

Eighteen trees of dwarf pines, planted as part of the background and setting for the memorial, were presented by Mr. Frank Bailey, Chairman of the Botanic Garden Governing Committee.

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GENERAL INFORMATION

Membership.—All persons who are interested in the objects and maintenance of the Brooklyn Botanic Garden are eligible to membership. Members enjoy special privileges. Annual Membership, $10 yearly; Sustaining Membership, $25 yearly; Life Membership, $500. Full information concerning membership may be had by addressing *The Director, Brooklyn Botanic Garden, Brooklyn, N. Y.* Telephone, 6173 Prospect.

The Botanic Garden is open free to the public daily from 8 a.m. until dark; on Sundays and Holidays open at 10 a.m.

Entrances.—On Flatbush Avenue, near Empire Boulevard (Malbone Street), and near Mt. Prospect Reservoir; on Washington Avenue, south of Eastern Parkway and near Empire Boulevard; on Eastern Parkway, west of the Museum Building.

The street entrance to the Laboratory Building is at 978 Washington Avenue, opposite Montgomery Street.

To Assist Members and others in studying the collections the services of a docent may be obtained. This service is free of charge to *members of the Botanic Garden;* to others there is a charge of 50 cents per person. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted.

To Reach the Garden take Broadway (B.M.T.) Subway to Prospect Park station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St. John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

PUBLICATIONS
OF THE
BROOKLYN BOTANIC GARDEN

RECORD. Established, January, 1912. An administrative periodical issued quarterly. Contains, among other things, the *Annual Report* of the director and heads of departments, special reports, announcements of courses of instruction, miscellaneous papers, and notes concerning Garden progress and events. Free to members of the Garden. To others one dollar a year; 25 cents a copy.

MEMOIRS. Established, July, 1918. Published irregularly.

Volume I, *Dedication Papers:* comprising scientific papers presented at the dedication of the laboratory building and plant houses, April 19–21, 1917. Price $3.50, plus postage.

Volume II. The vegetation of Long Island. Part I, The vegetation of Montauk: A study of grassland and forest. Price $1.00, plus postage.

CONTRIBUTIONS. Papers originally published in botanical or other periodicals, reissued as "separates," without change of paging, and numbered consecutively. This series includes occasional papers, as well as those embodying the results of research done at the Garden, or by members of its staff or students. Twenty-five numbers constitute one volume. Price 25 cents each, $5.00 a volume.

VOLUME II

26. *Plant composition and soil acidity of a Maine bog.* 4 pages, 1921.

27. *The origin of new varieties of Nephrolepis by orthogenetic saltation. II. Regressive variation or reversion from the primary and secondary sports of Bostoniensis.* 18 pages, 6 plates. 1922.

28. *Botanical exploration in Bolivia.* 13 pages. 1922.

29. *Anthracnose of the Boston fern.* 7 pages, 2 plates. 1923.

30. *Varietal resistance and susceptibility of Sorghums to Sphacelotheca Sorghi (Link) Clinton and Sphacelotheca Cruenti (Kühn) Potter.* 12 pages, 2 plates. 1923.

31. *The Melanconis disease of the butternut (Juglans cinerea L.).* 23 pages, 2 plates, 5 figs. 1923.

32. *New bud sports of Nephrolepis.* 21 pages, 2 plates, 4 figures. 1923.

LEAFLETS. Established, April 10, 1913. Published weekly or biweekly during April, May, June, September, and October. The purpose of the *Leaflets* is primarily to give announcements concerning flowering and other plant activities to be seen in the Garden near the date of issue, and to give popular, elementary information about plant life for teachers and others. Free to members of the Garden. To others, fifty cents a series. Single numbers 5 cents each.

GUIDES to the collections, buildings, and grounds. Price based upon cost of publication.

SEED LIST. Issued in December of each year.

AMERICAN JOURNAL OF BOTANY. Established, January, 1914. Published, in coöperation with the BOTANICAL SOCIETY OF AMERICA, monthly, except during August and September. Subscription, $6.00 a year.

ECOLOGY. Established, January, 1920. Published quarterly in coöperation with the ECOLOGICAL SOCIETY OF AMERICA. Subscription, $4.00 a year.

GENETICS. Established, January, 1916. Bi-monthly. Subscription, $6.00 a year.

BROOKLYN BOTANIC GARDEN

RECORD

VOL. XIII JULY, 1924 No. 3

EDITED BY

C. STUART GAGER

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AT LANCASTER, PA.

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BROOKLYN
BOTANIC GARDEN

RECORD

VOL. XIII JULY, 1924 No. 3

THE SMUTS OF CEREALS: THEIR NATURE, ECONOMIC IMPORTANCE, AND THE SIGNIFICANCE OF RECENT DISCOVERIES

The demonstration of the existence of specialized races in the smuts of the cereals is a fact of fundamental significance. The restriction of physiologic races of parasitic fungi to particular hosts has been long recognized among the rusts, powdery mildews, and other groups of fungi. A similar condition also has been demonstrated for the anther smut which attacks various members of the pink family.

So far as the smuts of cereals are concerned, it has been more or less generally assumed that physiologic specialization did not occur. A new light, however, is thrown upon the investigation of these destructive diseases by the discovery, at the Brooklyn Botanic Garden, of distinct races of the covered smut of barley in a single collection of material. In this particular case, the diseased heads of two varieties of barley were collected together, but experiments revealed the fact that while the smuts on the two varieties were indistinguishable on the basis of ordinary morphological characters, they did differ very strikingly in their physiologic behavior. They proved to be two well-defined races, each with a specific capacity for infecting definite varieties of barley. Similarly, distinct races of both loose and covered smuts of oats also have been discovered. In this case the original material of the smuts came from widely

separated sources. Further investigations may doubtless reveal a high degree of host specialization among these parasitic fungi.

The Value of Cereals.—The cereals are the most important food plants of the human race. Over practically the whole world some cereal, as wheat, oats, barley, rye, corn, rice, millets, and sorghums, supplies the basic food of the different peoples. All of these are grown in the United States, at least to some extent, and thus occupy a very important place in the activities of the farmers.

Since ancient times wheat has been a very important food crop. It constitutes the great bread crop of a large proportion of the human race. Somewhere in the world wheat is being harvested every week of the year. The total world production is about 3½ billion bushels. Before the war Russia ranked first as a producer of wheat and the United States ranked second, producing about one fifth of the world's total. Several European countries, as France, Hungary, and Italy, also grow large quantities. In India, Canada, Argentina, and Australia wheat growing is a very important phase of agricultural activity. The average annual per capita consumption of wheat in Canada is twelve bushels; in the United States, five and one half bushels; and in India, one bushel. Most European countries produce less wheat than they require for their needs and they obtain their surplus from the United States, Russia, India, Canada, Argentina, and Australia.

From the standpoint of production corn or maize is our most important cereal. The average annual production for 1910 to 1914 was 2¾ billion bushels. The United States produced about three quarters of the corn crop of the world. Argentina, Brazil, and Mexico grow considerable quantities of corn. Although this cereal was unknown to Europeans before the discovery of America, it is now grown extensively in other parts of the world where it is adapted. Some European countries, as Italy, the Balkan countries, Hungary, Spain, and Portugal, are important corn-producing regions. It is also grown in various parts of Africa and Asia. The chief use of corn is feed for hogs and cattle, and in this indirect way is of very great significance to man. However, a large quantity of corn is used directly for human food.

Rice holds a very important place among the food grains of the

world. The people living in the coastal sections of many countries of the Orient depend largely upon this crop. It is cultivated in nearly all tropical countries, but most of the rice is produced in India, Japan, China, and adjacent regions. Some rice is grown in the United States, Spain, Italy, and Egypt. From 1900 to 1921 the average annual production of rice in the world, excluding China, was approximately 108 billion pounds of cleaned rice.

Oats rank third in importance among the cereal crops of the United States. They are exceeded only by corn and wheat in value and acreage. Their principal use is as feed for horses and young stock, and in this respect they are unsurpassed by any other cereal. The two great world centers of oat production are in western Europe and the north central portion of the United States. During the period 1910 to 1914 about one quarter of the world oat crop was produced in the United States, and Russia produced about the same quantity. Other important oat-producing countries were Germany, Canada, France, and the United Kingdom. The average annual production in the United States was about 970 million bushels.

Barley does not occupy anything like as important a position in American agriculture as wheat, corn, and oats. The average annual production for the ten years, 1913 to 1922, was about 193 million bushels. To a considerable extent the crop is grown outside of the areas where corn and oats do well. The average world production of barley for 1906 to 1915 was nearly 1½ billion bushels. Russia produced over 25 per cent. of the world crop. Barley, however, is extensively cultivated in northern India, Central Europe, Spain, northern Africa, and Japan. This cereal is used for human food chiefly in the form of pearl barley for thickening soups. To some extent it is used in the preparation of breakfast foods and has also served as a substitute for wheat in baking bread. Its chief use, however, is for brewing and feeding animals.

Rye is a comparatively unimportant crop in the United States. Before the world war Russia produced more than one quarter of the rye. Germany and Austria-Hungary also were important producers of this cereal. In European countries it is largely used as

a substitute for wheat. This cereal is hardier than wheat and can be grown successfully in areas where the latter is not profitable.

The grain sorghums are recent introductions to American agriculture. For many centuries they have been extensively grown in the old world, for example, Africa, India, Manchuria, and western Asia. In these areas they constitute the staple cereal crop of the native population. The grain is used for human food as well as for animal feed. In the United States the grain sorghums are extensively grown in Texas, Oklahoma, and Kansas. The crop succeeds well in the dry regions, and in the southern section of the Great Plains area the crop is much more certain than corn. The grain sorghums are very largely used as a substitute for corn as feed for farm animals. Manufactured poultry foods consist of about one quarter sorghum grains. Sorghums also are used for griddle cakes and hot breads resembling corn bread. A breakfast food is also manufactured from sorghum grain.

The Importance of Cereal Diseases.—In view of the fundamental importance of cereals in the life of the human race, it is evident that a knowledge of the nature of the fungous diseases of these crops is of very great significance. Agriculturists have long been familiar with the destructiveness of rusts, smuts, mildews, and various other types of diseases. Certain rusts have proved to be particularly destructive and have long engaged the attention of investigators. The smut diseases, however, are also very destructive to the different kinds of cereals.

Kinds of Cereal Smuts.—There are a large number of different kinds of smuts which attack the different cereals. These species have many points of resemblance, but they can be distinguished from one another in various ways. In the accompanying table most of the cereal smuts are listed and the essential differences in their life history are brought out. In a few cases however, further investigations are necessary in order to clear up some points.

Bunt of Wheat.—The bunt of wheat is probably our most destructive smut. It destroys annually on an average about 10 million bushels of wheat in the United States. The damage done, however, varies considerably from season to season. It is also a

Smuts of Cereals

Group 1. Infection occurs in the seedling stage of the host. The spores are mainly seed borne; in some cases the spores in the soil are responsible for infection.

Bunt or Stinking Smut of Wheat.	*Tilletia laevis* Kühn
Bunt or Stinking Smut of Wheat.	*Tilletia tritici* (Bjerk.) Wint.
Flag or Leaf Smut of Wheat.	*Urocystis tritici* Kcke.
Stem Smut of Rye.	*Urocystis occulta* (Wallr.) Rab.
Bunt of Rye.	*Tilletia secalis* Kcke.
Loose Smut of Oats.	*Ustilago avenae* (Pers.) Jens.
Covered Smut of Oats.	*Ustilago levis* (K. & S.) Magn.
Covered Smut of Barley.	*Ustilago hordei* (Pers.) K. & S.
Covered Kernel Smut of Sorghum.	*Sphacelotheca sorghi* (Link) Clint.
Loose Kernel Smut of Sorghum.	*Sphacelotheca cruenta* (Kühn) Potter
Head Smut of Sorghum and Maize.	*Sorosporium reilianum* (Kühn) McAlpine
Bunt of Rice.	*Tilletia horrida* Tak.

Group 2. Infection occurs in flowering stage of the host. The spores are distributed by the wind at the blooming period of the crop and the parasite is carried over as a dormant mycelium in the grain. No external contamination of ripe grain occurs.

Loose Smut of Wheat.	*Ustilago tritici* (Pers.) Jens.
Loose Smut of Barley.	*Ustilago nuda* (Jens.) K. & S.
Loose Smut of Rye.	*Ustilago secalis* (?)

Group 3. Infection occurs in any young growing tissue of the host. The spores are primarily in the soil or barnyard.

Common Smut of Maize.	*Ustilago zeae* (Beckm.) Ung.

destructive disease in all the other wheat-growing regions of the world.

Bunt of wheat is caused by two closely related species of smuts, *Tilletia tritici* and *T. laevis*. These two species are distinguished by the fact that the spores of *Tilletia laevis* are smooth and more or less irregular in shape. On the other hand, the spores of *T. tritici* have a wall with reticulate thickenings, so that the spores viewed in surface appear as a network. They are also nearly spherical in shape and much more uniform in size.

Both species of bunt appear to have a similar life history. In each case the parasite gains entrance to the host plant in the seedling stage. Following penetration the fungus develops in the embryonic tissue of the host and growth becomes particularly vigorous in the developing ovary, so that the latter comes to be filled with the spores of the parasite. An infected plant can readily be recognized very soon after the heading of the grain. The heads appear somewhat greener and, since the infected kernel develops more rapidly than the normal, the glumes are pushed apart somewhat. The mature heads of diseased plants, since they are lighter, do not bend over or nod as is the case with the normal (Fig. 1).

The spores remain enclosed in the surrounding tissues of the ovary and constitute what is known as the smut ball. Since the diseased plants are harvested with the sound ones, these smut balls are more or less broken when the grain is threshed and the spores become scattered over the sound grain from the normal plants. Many smut balls, however, may escape, but these may be broken in the subsequent handling of the grain. The spores, which are very small and exceedingly numerous, have a very distinct, disagreeable odor, which is responsible for the common name of stinking smut. The injury to the wheat lies not only in the actual destruction of grain, but also in the dockage of the badly contaminated grain, which must be cleaned before grinding into flour.

It is usually the spores which are in contact with the outside of the kernel that are responsible for the infection of the young seedling. They come in contact with the kernels in various operations attending harvesting, threshing, and drilling. A machine that has threshed smutted wheat becomes badly contaminated with these

FIG. 1. Bunt of wheat. *a*, Infected head and smut balls. *b*, Normal head and sound grain.

dust-like spores, and if it is afterwards used to thresh a crop in which no smut is present, the kernels may become contaminated. In this way the smut appears the next season on a farm where it has been previously absent. Clean seed may also be contaminated

FIG. 2. Loose smut of wheat. At the left is a normal head, the head beside it showing a few normal spikelets at the tip.

by being placed in sacks which have contained smutted wheat. In the same way a contaminated drill may be a source of smut when clean seed is used. These spores, sown with the seed, germinate

under similar conditions. Accordingly, the young parasite is present to invade the susceptible seedling stage of the host.

In certain localities, however, the epidemics of smut are due to the presence of spores in the soil. This is particularly the case in eastern Washington and Oregon and also in Idaho. In threshing, the smut spores from an infected crop are blown out from the machines in enormous quantities and scattered long distances. In severely infected crops these are spoken of as smut showers. These spores land on the soil, especially in the fallow fields which are ready for the fall seeding. As soon as the autumn rains come the spores germinate and form a more or less saprophytic growth in the soil. When the seed is sown in such soil the young seedlings are likely to become attacked.

The Loose Smut of Wheat.—The loose smut of wheat also is coextensive with the cultivation of wheat. Ordinarily it is not a particularly severe disease. In some sections of Ohio, Indiana, Illinois, Missouri, and Virginia, however, one frequently finds 5 to 10 per cent. of the wheat destroyed, and in occasional fields as much as 20 per cent. This disease is recognized by the so-called "black heads" which are conspicuous soon after the wheat heads out. The black color of the head is due largely to the spores of the fungus which have been formed at the expense of the developing wheat tissues. These spores are readily disseminated by the wind, and soon nothing but the naked axis of the inflorescence is left (Fig. 2).

There is a very important difference in the life history of the loose smut of wheat as compared with bunt. The diseased plants shed the spores at about the time the normal, healthy plants have come into bloom. The spores are scattered by air currents and distributed upon the flowers of the healthy plants. Some of them reach the stigma of the flower and there germinate. The young mycelium grows down into the tissues of the ovary. As the kernel matures there is a slight growth of the fungous mycelium, but externally there is no evidence that the tissues of the kernel are really invaded by a parasite. The kernel apparently develops in a normal manner and appears entirely healthy. As a matter of fact, however, in these ripe kernels one may find a small amount of

dormant smut mycelium. When such a kernel is planted in the ground it produces the young wheat plant. At the same time, however, the mycelium of the parasite grows and develops in the embryonic tissues of the host. When the latter begins to form its flowers the fungus develops very rapidly and in place of the normal seed and adjacent tissues the smut spores are formed. Inoculation then takes place at the flowering period of the host. In this smut there can be no danger from storing the seed in smutted sacks or threshing with contaminated machinery. The infection takes place only at the flowering period of the host. The fungus lies dormant in the seed and when the latter germinates to form a new plant the mycelium renews its development.

Flag or Leaf Smut of Wheat.—The life history of the parasite causing this disease is similar to the smut which causes bunt. The infection takes place in the seedling stage from spores present either on the seed or in the soil. The infected plants, however, are very greatly stunted and commonly are prevented from heading, or if an infected plant does head, very little seed is produced. The fungus finally develops principally in the leaves and to some extent in the stems. Long lines of black tissue appear between the veins of the leaves due to the formation of the spores in linear masses. These later rupture and the spores escape. Leaf smut or flag smut is reported as particularly destructive in Australia and South Africa. Recently it was found in southern Illinois and adjacent regions, and is recognized as a disease of serious potential danger. The fact that infection takes place from spores present in the soil as well as from spores on the seed makes it a particularly persistent disease.

The Loose and Covered Smut of Oats.—The loose smut of oats is caused by *Ustilago avenae.* The infection of the oat plant takes place in the seedling stage from spores adhering to the grain. The fungous mycelium develops in the infected plant and when the latter blooms the characteristic black heads appear. The flowers of the infected plants are almost completely replaced with the fine, black, dusty spores of the parasite. The glumes or chaff of the oat are involved as well as the kernel and the destructiveness of this disease is at once apparent. Shortly after the diseased in-

FIG. 3. Covered smut of oats. The panicle at the left is partially smutted, the upper spikelets producing seed.

florescence pushes out from the enclosing sheath the spores are scattered by the wind over the oat field and finally the plant appears with only the bare axis of an inflorescence with the fragments of glumes and other parts still attached. The inoculation of a healthy oat plant usually takes place at the flowering period. Some of the spores which are widely distributed over the field adhere to the developing kernels. Plants may become inoculated in threshing operations and in the subsequent handling of the grain and seedling infection seems to be the rule.

The covered smut has a life history similar to that of the loose smut. Infection takes place in the seedling stage and the spores are developed in the floral region of the host. It also causes a more or less complete destruction of the kernel (Fig. 3). The glumes, however, are less involved. They remain more or less persistent and conceal the smut spore masses. The bases of the glumes are, however, more or less attacked and the tissues appear blackish due to the presence of the fungous spores among the host cells. The spores are distributed on the sound grain very largely in threshing operations. The two smuts accordingly differ in the time at which the contamination of the sound grain takes place.

These two smuts are more or less coextensive with the cultivation of oats. On an average probably 5 per cent. of the oat crop of the United States is destroyed by them.

The Loose and Covered Smuts of Barley.—There are two distinct smuts of barley—the covered smut caused by *Ustilago hordei* and the loose smut caused by *U. nuda.* So far as life histories are concerned, the covered smut is very similar to the covered smut of oats. Seedling infection occurs from spores which contaminate the seed in harvesting, threshing, and drilling operations. The loose smut, like the corresponding disease of wheat, develops from dormant mycelium in the ripe seed which arose from an infection taking place in the flowering period of the host. Both are fairly common in barley. The covered smut is particularly severe in the winter barleys which are grown in Virginia, Tennessee, and other parts of the South (Fig. 4).

Stem Smut of Rye.—The fungus which causes this disease is very similar to the one which produces the flag smut of wheat.

FIG. 4. Covered smut of barley.

The infected plants, however, more frequently head out, although usually no grain is produced. Ordinarily only a small proportion of the plants in a field is infected and the damage done is not particularly serious. Infection takes place in the seedling stage of the rye and probably for the most part from spores adhering to the grain, although the question as to the part which spores present in the soil may play has not been fully determined.

Loose Smut of Rye and Bunt of Rye.—Recently a loose smut of rye has been found. It seems to be of rare occurrence. It resembles somewhat closely the loose smut of wheat, but the complete details of its history have not been traced out.

Bunt of rye appears to be fairly common in the Balkan countries of Europe. Recently *Tilletia tritici* has been transferred to rye, and further investigations are necessary in order to determine the possible relation between bunt of wheat and rye.

Bunt of Rice.—This disease was first described in Japan and has since been found widely distributed in Java, Indo-China, Siam, and China. It also occurs throughout the main rice growing areas in Burma, and has been found on the east coast of Peninsular India and at Pusa. It has reached the United States and, for a time, was established in South Carolina and also in Louisiana. In this smut only a few individual grains of the head produce spores. It is difficult to detect the diseased grains without breaking them, although in some cases the glumes are forced apart a little and the black spore mass may be observed. The amount of damage caused by this bunt is usually slight, although in South Carolina it was regarded as a disease of very serious importance and successful efforts were made to stamp it out in that state. The parasite is closely allied to the smuts which cause the bunt of wheat. The life history has not been fully worked out, but there is considerable evidence that the fungus gains entrance in the seedling stage of the host.

The Covered Kernel Smut of Sorghum.—The most serious smut of sorghum is unquestionably the covered kernel smut. It is found wherever sorghums are grown and frequently causes very heavy losses. It is not uncommon to find fields showing 20 to 50 per cent. of the heads destroyed. The infection of the sorghum plant

takes place in the seedling stage from spores adhering to the grain. The infected plants, however, can not be detected until about the time for heading out, then one can observe the enlargement of the ovaries due to the unusual development of the parasite. The kernels are very much hypertrophied and constitute well-defined smut balls. These contain enormous numbers of the dust-like spores. These smut balls are broken in threshing and similar operations and the spores come in contact with the sound grain (Figs. 5*a* and 5*b*).

The Loose Kernel Smut of Sorghum.—The life history of the parasite causing loose kernel smut is somewhat similar to that of the covered smut, but its pathological effects on the host are strikingly different. The infected plants head out much earlier than normal plants and are noticeably dwarfed in nearly all varieties. They also show more tillering and branching as compared with the normal. Sometimes there is a marked enlargement of the glumes. The smut balls are much longer, more slender, and cylindric in shape. They break open very readily and permit the distribution of the spores. This rupturing of the membrane occurs even before the smut ball has completely emerged from the glumes. The loose smut also is very widely distributed in the sorghum-growing areas of the world. It does not, however, appear to be as destructive as the covered smut (Figs. 5*b* and 5*c*).

The Head Smut of Sorghum.—The head smut of sorghum differs from the sorghum smuts just mentioned in the fact that the entire head is more or less converted into a mass of smut spores. It does not seem to be so common as either the covered or loose kernel smut. In certain localities, particularly in Kansas and Texas, it is, however, common and destructive on some varieties of sorghums. It seems to depend for its distribution very largely upon spores in the soil, although seed-borne spores also are a factor in its distribution. This smut is particularly interesting from the fact that it occurs on maize as well as on sorghum (Fig. 6).

The Common Maize Smut.—This disease may be found practically wherever maize is grown. It occurs on the roots, stems, leaves, tassels, or ears. It is perhaps most conspicuous on either the tassels or ears, where it forms very characteristic hypertrophied

FIG. 5. *a*, covered kernel smut of sorghum on Sumac Sorgo; *b*, normal head of Sumac Sorgo; *c*, loose kernel smut of sorghum on Valley Kaoliang.

structures. The chief damage perhaps is done when the ears are attacked, although the presence of infected areas on other parts of the plant may have an influence on its vigor (Fig. 7).

Maize smut differs from any of the others previously mentioned. The spores seem able to infect any young developing tissue instead of the young flower or seedling, as is the case in the other smuts. In consequence, from an initial infection on a young maize plant in the early summer we may have secondary infections on other plants throughout the season. The fungous mycelium does not become distributed throughout the plant. It occurs only locally and causes characteristic hypertrophy or enlargement of a local mass of cells. The infection takes place locally on the parts of the plant where the smutted growths ultimately appear. A period of only about two weeks is required for the fungus to complete its life cycle—for the spores to germinate, the germ tube to penetrate, the mycelium to develop and again form the spores. In this way a succession of smut pustules may appear in the plants during a single season. The spores appear to live over the winter in the barnyard or field. The entrance of the parasite into the host appears to a considerable extent to be dependent upon injury to the plant. Perhaps the explanation of the destructiveness of corn smut in the western corn belt of Kansas, Nebraska, and adjacent regions is due to the extensive injury to the plants caused by the strong winds.

The Earlier Investigations on Smuts.—The smuts have been studied from various standpoints for very many years. The earlier students were concerned with tracing out the nature of the disease and the life history of the causal organisms. Such investigations required painstaking efforts in order to determine accurately the significant facts in the life history of the parasite. Step by step investigators like Tillet, Prevost, Tulasne, Kühn, Brefeld, Jensen, Maddox, and others brought out the essential points and established clearly the relationship between the parasite and its host. These investigators also were concerned with the relationship of the different species of smuts and their proper naming.

The possibility of the control of the smuts has long engaged the attention of many investigators and all sorts of methods have been

tried out. The discovery of the important points in the life history of these parasites has made possible great progress in the development of methods of seed treatment since, in many cases at least, the spores are carried on the seed. Many chemical substances have been tested and various methods employed in their

FIG. 6. Head smut of sorghum on Red Amber Sorgo.

use. The hot-water method of seed treatment also has proved of value in some cases.

There are, however, certain disadvantages in any method of seed treatment. For one thing, it is difficult to get farmers to apply treatments which involve any extra trouble and expense. Further, all of the effective seed treatments, unless very carefully handled, are likely to cause considerable injury to the seed. It is

also true that some of the smuts can not be controlled by any known method of seed treatment, since they are not primarily distributed by spores present on the outside of the seed or by dormant mycelium in the seed. In many cases we have the very serious problem of soil infestation where the spores, finding lodgment in the soil, are the main source of producing infection in the plant. When the crop is planted and the conditions are favorable for germination of the seed of the host, the spores also germinate and may gain entrance. One of the chief problems in the control of bunt of wheat in eastern Washington and Oregon and Idaho is due to the fact that soil infestation occurs on an extensive scale. Similarly the main problem in connection with the flag smut of wheat, the head smut of sorghum and corn, and common corn smut is due to the fact that the spores live over in the soil.

Recent Investigations of Cereal Smuts.—While a great deal of effort is still being spent on perfecting methods of seed treatment for the control of the smuts which are seed-borne, recent investigations on the cereal smuts have developed along somewhat new lines. One important phase has been the determination of the exact influence of environal factors on infection. The agriculturist long has known that the weather plays an important part in the occurrence of smuts as well as other diseases. Consequently, the determination of the exact influence of temperature, soil moisture, soil acidity, and other possible factors has been necessary in order to make further progress along some other lines of study. In the investigations at the Brooklyn Botanic Garden we have carried out extensive experiments with the covered smut of oats, the loose and covered smuts of sorghum, and the covered smut of barley. It has been demonstrated that infection in the covered smut of oats will take place over a wide range of temperature, from 5° to 30° C. The highest infections, however, were obtained at temperatures of 20° or 25° C. Low soil moistures, also a slightly acid soil, proved to be much more favorable for infection than high soil moistures or an alkaline soil. The infection of sorghums by the covered and loose smut will also take place over a fairly wide range of temperature, from about 15° to 35° C. Both these smuts are favored by a low soil moisture as compared

with a high soil moisture, and while infections occur over a rather wide range of soil reactions, the severest infection occurs in the slightly acid soil. It has also been found that infection with the covered smut of barley will take place over a wide temperature range from 5° to 30° C. The highest percentages of infection were obtained at 15°. In general, higher percentages of infection were obtained in a soil moisture of 50 per cent. than in one of 40 per cent., provided the soil was acid in reaction. It must be emphasized, however, that in all these cases these various factors influence each other. They are interdependent factors and their interaction determines whether the infection will take place and also the severity of the attack.

Another line of investigation has been the determination of the varietal resistance of hosts. The best and ultimate solution of the control of various plant diseases is the utilization of resistant varieties. Consequently, the determination of varieties which will produce a full crop and withstand particular diseases becomes a matter of very great importance. In the investigations at the Garden a large series of varieties of sorghums, oats, and barley have been tested for the resistance to their respective species of smuts. Various sorghums, as the Milos and Feterita, have shown a marked resistance to both the covered kernel smut and the loose kernel smut. On the other hand, the Kafirs and Sorgos have been more or less susceptible. The varieties in general have responded in a similar fashion to the loose kernel smut. Darso, however, has proved to be highly resistant to the covered kernel smut and moderately susceptible to the loose kernel smut. A large number of varieties of oats also have been tested for their behavior to both loose and covered smut. While the great majority of the varieties are susceptible, a few have been found to be notably resistant. In general the oats belonging to the *Sterilis* group, including such varieties as Fulghum and Red Rustproof, have shown a marked degree of resistance. Again, it is an interesting fact that the majority of the varieties have responded somewhat similarly to the two smuts. A few varieties, however, have behaved differently with reference to them.

Still another important line of investigation has to do with the question of the inheritance of the disease-resistant quality. It frequently happens that a variety susceptible to a serious disease possesses certain valuable qualities, such as high yield, stiff straw, short ripening period, etc. The problem then comes to cross such a variety with one whose chief value perhaps is its resistance, with

FIG. 7. Common smut of corn.

the expectation of obtaining a progeny which will possess the high degree of resistance of one parent and the desirable agronomic characters of the other. Success in such procedure involves a thorough study of the inheritance of the resistance quality and the possibility of various new combinations of characters. Our own investigations so far have been with crosses involving very resistant and very susceptible varieties of oats and a large amount of interesting and valuable data have been obtained.

Finally, the investigation along the line of the delimitation of the specialized races of smuts is a matter of very great importance. The significance of these races is great and for successful breeding work we must have exact knowledge regarding their occurrence and the extent of their specialization. Studies at the Brooklyn Botanic Garden already have revealed the existence of a number of races of the covered smut of barley and the two smuts of oats.

GEORGE M. REED,
Curator of Plant Pathology.

FUNDS FOR RESEARCH

In the Tenth Annual Report of the Brooklyn Botanic Garden for the year 1920 record was made of the pledge of the late Mr. Alfred T. White, on behalf of himself and two other friends of the Botanic Garden, of $50,000, or so much thereof as might be necessary within the years 1921–1924 for the inauguration of research in plant pathology—this sum to become available in stated amounts during those years. By judicious economies and revision of the original plans, enough will remain to carry the work through 1925. This balance is made a free gift to the Garden.

In the Annual Report just cited announcement was also made of the appointment of Dr. George M. Reed as curator of plant pathology to organize and direct this work. As previously noted, Dr. Reed entered upon his duties on January 1, 1921, and early in that month a meeting of the Botanic Garden Governing Committee was held at the Laboratory Building primarily for the purpose of meeting Dr. Reed. In his letter of gift to the Board of Trustees under date of November 15, 1920, Mr. White said: "I believe that the establishment of this new department will add both to the reputation and usefulness of the Garden."

Mr. White also clearly recognized that the contemplated project (disease resistance in plants) was not in the nature of a delimited problem that could be completed in four years, and in the letter above cited he expressed the hope that some time before the close of the four years funds would be forthcoming from some source

to place the work on a generous and permanent foundation.

The experimental results obtained by Dr. Reed and Dr. Faris during the first three years include the basic discovery of physiological races in the smuts of the cereal grains. The importance of these results, described more in detail in Dr. Reed's article elsewhere in this issue of the RECORD, can hardly be overestimated from either the theoretical or practical point of view, and these results alone amply justify the expenditure of money and effort already made.

The Botanic Garden is glad to be able to announce that at a meeting of the Governing Committee on May 21 a letter of May 1, 1924, was read containing an offer from three friends of the Garden, who wish to remain anonymous, to underwrite $7,500 a year for the years 1926, 1927, and 1928 for such purposes in plant pathology work as the Director of the Garden may suggest with the approval of the Governing Committee.

This most generous gift will insure the continuation of the work, substantially as now organized, until the end of 1928. Before the expiration of this period it is hoped that the permanent endowment funds of the Botanic Garden may be sufficiently augmented to place this and other research work on a permanent basis. Its importance, from the standpoint of both pure and applied science, merit the most generous financial support.

C. STUART GAGER.

NATIONAL RESEARCH FELLOWSHIPS IN THE BIOLOGICAL SCIENCES

The Board of National Research Fellowships in Biological Sciences (of the National Research Council), Prof. Frank R. Lillie, Chairman, met on April 23 and made twenty-four appointments, of which ten were in botany, eight in zoology, five in psychology, and one in anthropology. The fellows in botany are E. G. Anderson, James A. Faris, E. F. Hopkins, J. H. Hoskins, C. R. Hursh, Marian Irwin, A. J. Riker, William Seifriz, F. B. Wann, and R. H. Wetmore.

Dr. Faris, who has been Research Fellow at the Brooklyn Bo-

tanic Garden since November 15, 1921, on the Alfred T. White Fund for Research in Plant Pathology, will continue his investigations in plant pathology, now under way, at the Brooklyn Garden, in cooperation with Dr. George M. Reed. As previously reported, the general project of which Dr. Faris's work is a part is the problem of disease resistance in plants.

The National Research Fellowships are supported by a contribution of the Rockefeller Foundation and are administered by a special Board of National Research Fellowships in the biological sciences, appointed by the National Research Council. The fellowships are open to citizens of the United States and Canada who possess a Ph.D., or its equivalent. They are intended for candidates in the earlier years of post-doctorate work, and are designed to recruit men and women as leaders of research in the universities and research establishments of the United States and Canada.

The basic stipends awarded are $1,800 for unmarried fellows and $2,300 for married fellows per annum. These stipends may be increased when there are other dependents or for other cogent reasons.

The fellowships are not granted to any institution or university, but the choice of place to work is left to the fellow, subject to the approval of the fellowship board. The appointments are for full time and no other remunerative or routine work is permitted, except that during the college year the fellows may, by written permission of the board, give a portion of their time, in general not more than one fifth (outside preparation included), to teaching of educational value to themselves, or to attendance on advanced courses of study.

The particular individual with whom a fellow wishes to work should, ordinarily, have agreed to accept him, prior to the consideration of his application by the board. It is further required that the fellow be charged no fees or tuition by the institution where he chooses to work.

JOINT MEETING ON THE CONSERVATION OF OUR NATIVE WILD FLOWERS

On Wednesday, May 28, a joint meeting of several societies and individuals interested in the conservation of our native wild plants was held at the Garden. At the morning meeting Miss Ellen Eddy Shaw spoke on the work of her department in the Children's Gardens. After her lecture in the Laboratory Building, the visitors were conducted to the Children's Gardens in the southern part of the Garden, where Miss Shaw explained the methods of instruction.

In the afternoon the report was received of the Committee on Conservation of Native Plants appointed last May at a similar meeting at the Garden. The committee appointed at that time was as follows: Dr. R. C. Benedict, of the Brooklyn Botanic Garden, Chairman, representing the American Fern Society; Dr. G. Clyde Fisher, of the American Museum of Natural History, from the New York Bird and Tree Club; Dr. Homer D. House, of the New York State Museum, from the Wild Flower Preservation Society of America; and Dr. M. A. Howe, of the New York Botanical Garden, from the Torrey Botanical Club, and also Attorney Augustus O. Bourne, Jr.

In his report, Dr. Benedict stated that for the present the most practicable way to gain legal protection seemed to be the insertion of the word "plants" in the Private Parks section of the State Conservation law. This amendment has been passed by the New York State Senate, but not by the Assembly. Dr. Homer D. House, New York State Botanist, also spoke in favor of legislation and showed lantern slides of some of the species needing protection.

In the general discussion which followed the consensus of opinion was that the most effective way to create popular sentiment in favor of plant conservation is through education, particularly by instruction of the children in the elementary and secondary schools. Mrs. Francke, of the North Country Garden Club, Long Island, reported that placards placed along the roads in the north shore region of Long Island asking passersby to spare the dogwood had

evidently been respected and had produced a very favorable result.

Dr. Benedict stated that the most practicable present method by which our native wild plants can be saved is through initiative of private individuals who will take steps to establish small sanctuaries or private parks where the chief emphasis is on the protection of wild flowers and their propagation with a view to reestablishing them in wider areas. The question of wild plant propagation should make a fascinating hobby, and many species are not difficult of reproduction, as has already been demonstrated. For example, it has been proved to be perfectly feasible to reestablish the fringed gentian merely by scattering carefully collected seeds.

The committee was reelected for the ensuing year and increased by the following members: Mrs. E. G. Britton, Honorary Curator, New York Botanical Garden; Mrs. Francke, representing the Long Island zone of the Garden Clubs of America; and Dr. Arthur H. Graves, Curator of Public Instruction, Brooklyn Botanic Garden.

On the resignation of Dr. Benedict from the chairmanship, Dr. G. Clyde Fisher was appointed chairman for the ensuing year.

The following organizations were invited to send official delegates to this meeting: Brooklyn Botanic Garden, New York Botanical Garden, Federated Garden Clubs of New York State, National Plant, Flower and Fruit Guild, American Scenic and Historic Preservation Society, Horticultural Society of New York.

VENUS'S FLYTRAP IN BLOOM

Among the plants of special interest which have recently flowered in the conservatories is the Venus's Flytrap, *Dionaea muscipula*. Its natural habitat is limited to a small area on the coastal strip near Wilmington, North Carolina. This plant is closely related to the more common Sundew (*Drosera*), and both are insectivorous plants. The leaves form a rosette. Each leaf has a broad stem and a bi-lobed blade with a number of rigid teeth along the margin. The midrib forms a hinge so that the halves of the blade are able to open and shut. The blades are covered with glands, reddish in the natural state, but green when grown in the

shade. Each half of the blade has three very sensitive hairs. When one or more of these hairs, on either side of the blade, is touched by an insect or other object a stimulus is transmitted to the midrib, the blades fold quickly together, and the teeth interlock as when one folds his hands. By this mechanism insects are constantly entrapped. The surface glands then secrete a fluid with properties similar to those of the gastric and pancreatic juices of the digestive system of mammals, and the digested protein material

FIG. 8. Venus's Flytrap (*Dionaca muscipula*) in bloom, in the conservatories, Brooklyn Botanic Garden.

is then absorbed by the leaf, serving as animal diet for the plant. In a similar way *Dionaea* will digest and absorb small bits of lean meat. Experiment shows that this animal diet is not necessary for the plant.

Dionaea was first described by the American botanist, Ellis, in a communication sent to Linnaeus in 1768. Linnaeus declared it a wonder of nature (*miraculum naturae*), but did not recognize it

as carnivorous. Charles Darwin refers to the plant as "one of the most wonderful in the world," and devotes an entire chapter of his *Insectivorous Plants* to describing his investigation of its structure and physiology. In his letter of acknowledgment to Ellis (written in Latin from Upsala, Sweden, October 16, 1768), Linnaeus says: "I yesterday received your welcome letter, accompanying the description, character, and figure of that most rare and singular plant the *Dionaea,* than which, certainly, nothing more interesting was ever seen. I laid this communication before our Royal Academy of Sciences, today, nor was it received without high admiration and astonishment. I am charged by that learned body to transmit to you its best thanks, for one of the most valuable communications it ever received, and which is ordered to be the first article in the ensuing volume of our *Transactions.*

"For my own part, though I have doubtless seen and examined no small number of plants, I must confess I never met with so wonderful a phenomenon."

Ellis suspected the plant was carnivorous, for in a letter of October 11, 1768, to Mary, Duchess of Norfolk, he says: "I must further desire your Grace's acceptance of a print of one of the rarest productions of the vegetable kingdom. 'Tis a new Sensitive Plant, and formed in such an extraordinary manner as if the Great Author of Nature intended it to receive some nourishment from the animals it seizes." In this same letter Ellis expressed the erroneous opinion that the glands "seem to be the irritable part."

C. S. G.

TENTH ANNUAL SPRING INSPECTION

The Tenth Annual Spring Inspection of the Botanic Garden by trustees, Woman's Auxiliary, members, and invited guests was held on Tuesday afternoon, May 13, 1924, from 3:30 until 6:00 p.m. About 650 guests were present, and the weather was all that could be desired.

The tour of inspection started from the Laboratory Building promptly at half past three, the guests proceeding in groups of

about 50, accompanied by members of the Garden staff as guides. Members of the Boys' and Girls' Club of the Garden preceded the guests carrying flags to indicate in advance the route to be followed.

The itinerary was as follows: (1) The Japanese Garden, where several new features had been installed by Japanese workmen since last year; (2) The Alfred T. White memorial bronze tablet and seat, unveiled since the preceding inspection; (3) The west side of the Brook; (4) The Rock Garden, with new species and new labels added since last year; (5) The Ecological Section and across the General Systematic Section; (6) The Conservatories; (7) The Boys' and Girls' Club Room in the Laboratory Building. Here were on view for the first time the two flower panels painted in oil by Miss Elizabeth Tyler. On these panels wild flowers (chiefly, but not exclusively, native American) are arranged in seasonal sequence, beginning with skunk cabbage and Forsythia, and ending with witchazel and other late fall wild flowers. There were also several other new features in this room. (8) The main floor of the Laboratory Building, where the following exhibits were on view:

(*a*) Exhibit of oil paintings of wild flowers of Westchester County and adjacent regions. These beautiful paintings, 164 panels illustrating 400 species, were exhibited by courtesy of the artist, Miss Eloise Payne Luquer.

(*b*) Exhibit of thirty-five pencil sketches of views in the Brooklyn Botanic Garden made by Mr. Clifford Sheen, Illustrator, and exhibited by courtesy of Mr. Sheen.

Tea was served in the main Rotunda from 4:30 until 6 o'clock by the Woman's Auxiliary of the Garden.

NOTES

The first number of a new bi-monthly publication, *Museum News,* appeared on New Year's Day, 1924. This is an organ of The American Association of Museums, and will include the work of botanic gardens as well as of museums. It may be found on file in our library. The Association will also continue to publish

its monthly organ, *Museum Work*. The May–June, 1924, issue of the latter contains an article on "The Educational Value of a Botanic Garden," based upon the work of the Brooklyn Botanic Garden.

Unseasonable warm weather brought dandelions and heath (*Erica*) into bloom on January 18, 1924, and on the following day the Chinese witch-hazel (*Hamamelis mollis*). A period of low temperatures then occurred, followed by a second unusually warm spell on January 23, when other flowers on the same witch-hazel bush came into bloom.

In harmony with the proclamation by the Acting Mayor of the City of New York, requesting the cessation of public activities in private as well as public business during the funeral of ex-President Woodrow Wilson, the building and offices of the Botanic Garden closed at 2:45 p.m. on Wednesday, February 6.

Recent visitors to the Garden include: February 6, Moses Jacobson, formerly professor of physics at the Agricultural University, Gory-Gorki, Russia; Dr. T. Nakai, Imperial University, Tokyo; Prof. C. E. Allen, University of Wisconsin, Madison; Prof. Alice M. Ottley and Dr. Helen J. Davis, of the department of botany of Wellesley College, Prof. Ralph R. Stewart, Gordon College, Rowalpundi, India; Prof. Godfrey H. Thomson, Durham University (England); and Prof. J. Massart and Madame Massart. Professor Massart is director of L'Institut Botanique Leo Errera and professor of botany in the University of Brussels, Belgium.

By invitation the Brooklyn Botanic Garden has become a member of the Civic Council of Brooklyn.

The Library School of the New York Public Library, including forty students under the direction of two instructors, visited the Garden Library on the afternoon of May 23. A short talk was given on the methods in use at the Brooklyn Botanic Garden Library and the many questions asked indicated the interest shown by the students regarding library problems. Tea was served in Room 327, where the librarian introduced Dr. Graves, of the Botanic Garden staff, who spoke of the activities of the Garden. The

class was then shown about the grounds by Dr. Graves and Miss Young.

Motion-Picture Reels on Tea.—On the afternoon of June fourth 500 pupils from the Brooklyn Public Schools came in classes with their teachers to view the first showing of the motion-picture reels illustrating the tea industry. These reels were received at the Garden on May 1, 1924, as a gift from Sir Thomas Lipton. After the lecture the pupils were photographed in front of the Laboratory Building. The reels were shown again to about 400 pupils on the afternoon of June 10.

The Heads of Department Association of the Borough of Brooklyn met at the Botanic Garden on May 14. Before the meeting was held, at which the Department had its annual election of officers, refreshments were served. Following the meeting, Miss Ellen Eddy Shaw, Curator of Elementary Instruction, welcomed the Department to the Botanic Garden, and spoke briefly on the cooperation between the Garden and the Heads of Department. At the close of the meeting the members inspected the Children's Room, and then visited the grounds under the guidance of Mr. Free. This was the annual meeting of the Association. There were 90 members present.

Registration in Spring Courses.—The registration in the spring courses for adults has been as follows: Greenhouse work for teachers (Miss Shaw), 44; The story of plant evolution (Dr. Gundersen), 6; Plants in the home (Mr. Free), 44; Trees and shrubs of Greater New York (Dr. Graves), 59; Spring flowers or ferns (Dr. Gundersen), 23; Spring Nature Study (Miss Hammond), 151.

Harvard University Botanic Garden.—The Brooklyn Botanic Garden received an invitation from the Visiting Committee of the Botanic Garden of Harvard University to attend a private view of that garden on Wednesday afternoon, June 11, 1924. It has been announced that the Harvard garden, which is one of the oldest scientific departments of Harvard University, having been founded in 1807, is to be made a testing ground for hardy herbs

suitable for culture in the region of Cambridge, Mass. The garden has an area of seven acres and the director is Mr. Stephen F. Hamblin.

Wild Flower Preserve.—We learn from the *Wild Flower,* the new quarterly publication of the Cincinnati Chapter of the Wild Flower Preservation Society of America, that Mr. J. Nelson Caldwell has donated to the city of Cincinnati land known as the "Caldwell Tract at Hartwell," to be known in memory of his wife as the "Stella Ross Caldwell Wild Flower Preserve." Mr. Caldwell has already donated the "Rawson Tract" in Clifton as a Bird Reserve. It is stated that these localities are now practically a part of the park system of the city.

We also learn from the same publication that in the early spring of 1921 Mr. Walter Hofer planted a tract of about one half acre of land at the extreme southwest of the school grounds at East High School for the establishment of a small woodland of native American trees and shrubs and a sanctuary for wild flowers. Such work is worthy of emulation in other communities.

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GENERAL INFORMATION

Membership.—All persons who are interested in the objects and maintenance of the Brooklyn Botanic Garden are eligible to membership. Members enjoy special privileges. Annual Membership, $10 yearly; Sustaining Membership, $25 yearly; Life Membership, $500. Full information concerning membership may be had by addressing *The Director, Brooklyn Botanic Garden, Brooklyn, N. Y.* Telephone, 6173 Prospect.

The Botanic Garden is open free to the public daily from 8 a.m. until dark; on Sundays and Holidays open at 10 a.m.

Entrances.—On Flatbush Avenue, near Empire Boulevard (Malbone Street), and near Mt. Prospect Reservoir; on Washington Avenue, south of Eastern Parkway and near Empire Boulevard; on Eastern Parkway, west of the Museum Building.

The street entrance to the Laboratory Building is at 978 Washington Avenue, opposite Montgomery Street.

To Assist Members and others in studying the collections the services of a docent may be obtained. This service is free of charge to *members of the Botanic Garden;* to others there is a charge of 50 cents per person. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted.

To Reach the Garden take Broadway (B.M.T.) Subway to Prospect Park station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

PUBLICATIONS
OF THE
BROOKLYN BOTANIC GARDEN

RECORD. Established, January, 1912. An administrative periodical issued quarterly. Contains, among other things, the *Annual Report* of the director and heads of departments, special reports, announcements of courses of instruction, miscellaneous papers, and notes concerning Garden progress and events. Free to members of the Garden. To others one dollar a year; 25 cents a copy.

MEMOIRS. Established, July, 1918. Published irregularly.

Volume I, *Dedication Papers:* comprising scientific papers presented at the dedication of the laboratory building and plant houses, April 19–21, 1917. Price $3.50, plus postage.

Volume II. The vegetation of Long Island. Part I, The vegetation of Montauk: A study of grassland and forest. Price $1.00, plus postage.

CONTRIBUTIONS. Papers originally published in botanical or other periodicals, reissued as "separates," without change of paging, and numbered consecutively. This series includes occasional papers, as well as those embodying the results of research done at the Garden, or by members of its staff or students. Twenty-five numbers constitute one volume. Price 25 cents each, $5.00 a volume.

VOLUME II

26. *Plant composition and soil acidity of a Maine bog.* 4 pages, 1921.

27. *The origin of new varieties of Nephrolepis by orthogenetic saltation. II. Regressive variation or reversion from the primary and secondary sports of Bostoniensis.* 18 pages, 6 plates. 1922.

28. *Botanical exploration in Bolivia.* 13 pages. 1922.

29. *Anthracnose of the Boston fern.* 7 pages, 2 plates. 1923.

30. *Varietal resistance and susceptibility of Sorghums to Sphacelotheca Sorghi (Link) Clinton and Sphacelotheca Cruenti (Kühn) Potter.* 12 pages, 2 plates. 1923.

31. *The Melanconis disease of the butternut (Juglans cinerea L.).* 23 pages, 2 plates, 5 figs. 1923.

32. *New bud sports of Nephrolepis.* 21 pages, 2 plates, 4 figures. 1923.

35. *Factors Influencing Infection of Hordeum sativum by Ustilago Hordei.* 26 pages, 2 plates, 7 figures. 1924.

LEAFLETS. Established, April 10, 1913. Published weekly or biweekly during April, May, June, September, and October. The purpose of the *Leaflets* is primarily to give announcements concerning flowering and other plant activities to be seen in the Garden near the date of issue, and to give popular, elementary information about plant life for teachers and others. Free to members of the Garden. To others, fifty cents a series. Single numbers 5 cents each.

GUIDES to the collections, buildings, and grounds. Price based upon cost of publication.

SEED LIST. Issued in December of each year.

AMERICAN JOURNAL OF BOTANY. Established, January, 1914. Published, in coöperation with the BOTANICAL SOCIETY OF AMERICA, monthly, except during August and September. Subscription, $6.00 a year.

ECOLOGY. Established, January, 1920. Published quarterly in coöperation with the ECOLOGICAL SOCIETY OF AMERICA. Subscription, $4.00 a year.

GENETICS. Established, January, 1916. Bi-monthly. Subscription, $6.00 a year.

BROOKLYN BOTANIC GARDEN

RECORD

VOL. XIII OCTOBER, 1924 No. 4

EDITED BY
C. STUART GAGER

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BROOKLYN BOTANIC GARDEN

Scientific, Educational, and Administrative Officers

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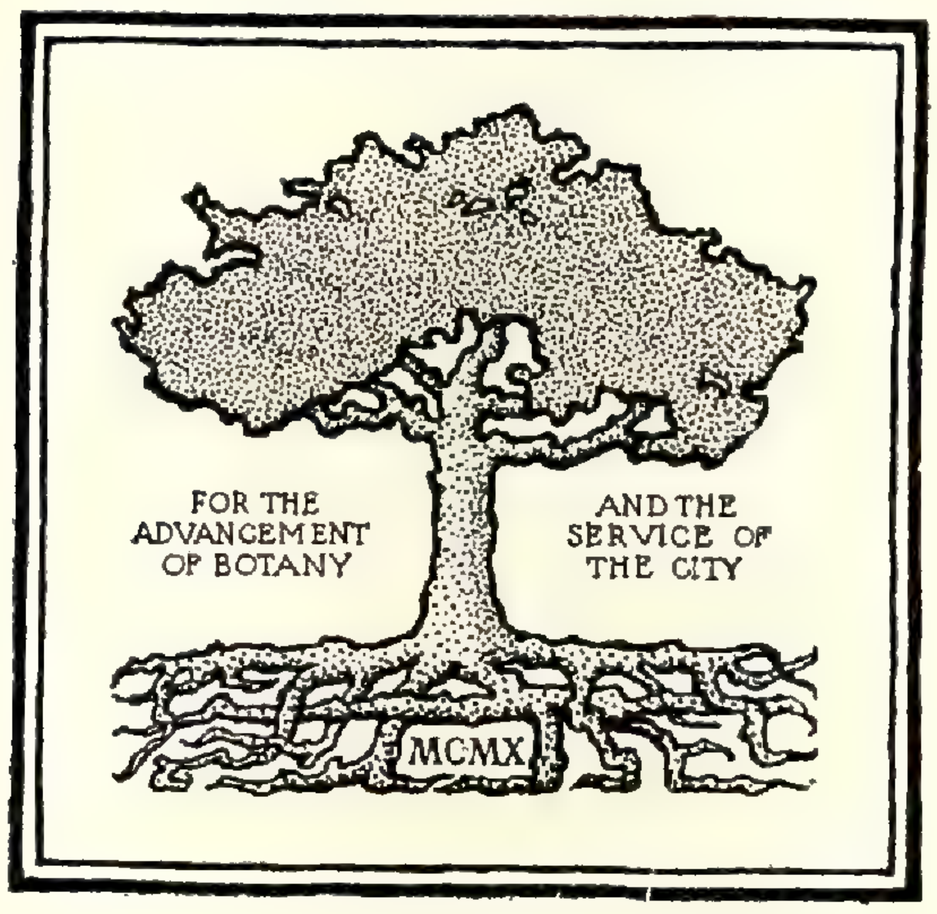
BROOKLYN BOTANIC GARDEN

RECORD

EDITED BY

C. STUART GAGER



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ANNOUNCEMENT

Beginning with the present number, and hereafter, the annual PROSPECTUS of Courses, Lectures, etc., offered by the Brooklyn Botanic Garden will be issued in September instead of December, as heretofore. This change has been adopted partly because certain courses have their beginning in September, continuing into June of the following year. Therefore, the logical time for their announcement should be in early September.

The change is made also because the subject matter of the PROSPECTUS pertains to educational matters, and for the sake of closer conformity with the school calendar, we feel that its appearance should coincide with the beginning of the school year.

BROOKLYN
BOTANIC GARDEN
RECORD

VOL. XIII OCTOBER, 1924 No. 4

I. COOPERATION WITH LOCAL SCHOOLS

The Brooklyn Botanic Garden aims to cooperate in every practicable way with the public and private schools of Greater New York in all matters relating to the study of plants. The purpose of the Garden in this connection is to supplement and enrich the school work in the way of instruction, demonstration, study material, etc., which otherwise would not be available.

Geography classes, as well as classes in nature study and botany, are finding the collection of useful plants in the economic plant house, and also our Japanese Garden, valuable adjuncts to their class work. Arrangements may be made by teachers of geography to have their classes study these collections under the guidance of a docent. Illustrated lectures for geography classes may also be arranged for at the Garden.

A. Talks at Schools.—The principals of public or private schools may arrange to have lantern talks given at the schools on various topics related to nature study, such as garden work with children, tree planting, and Arbor Day. If an illustrated lecture is desired, the lantern and operator must be provided by the school, but slides will be furnished by the Botanic Garden. Address the *Curator of Elementary Instruction* for list of talks and for appointments.

B. School Classes at the Garden.—(*a*) Schools not provided

with a stereopticon, and other schools, may arrange for classes, accompanied by their teachers, to come to the Botanic Garden for lectures either by the teacher or by a member of the Garden Staff.

(*b*) Notice of such a visit should be sent at least *one week* previous to the date on which a talk is desired. These talks will be illustrated by lantern slides, and by the conservatory collection of useful plants from the tropics and subtropics. Spring and fall announcements of topics will be issued during 1924–25.

(*c*) The Garden equipment, including greenhouses, plant material, lecture rooms, lantern and slides, is at the disposal of teachers who desire to instruct their own classes at the Garden. Arrangements must be made in advance so that such work will not conflict with other classes and lectures. For High School classes address *Curator of Public Instruction.* For Junior High and Elementary School classes address *Curator of Elementary Instruction.*

(*d*) The principal of any elementary or high school in Brooklyn may arrange also for a series of six lessons on plant culture to be given during the fall or spring to a class. These lessons will be worked out for the most part in the greenhouse. Such a course must be arranged for in advance, and the class must be accompanied by its teacher. Adapted for pupils above the fourth grade.

C. School and Home Gardening.—In order to encourage gardening in the school and at home, an annual Children's Garden Exhibit is held at the Garden in September. Prizes for excellence in various subjects are awarded to both schools and individuals. The privilege of competition in this exhibition is open to any school and also to any boy or girl in Brooklyn, even though the garden products exhibited may have been raised at his summer home. A *Leaflet* describing in detail the conditions for the exhibit and the prizes offered will be mailed on request.

The exhibit for 1924 will be held on *Friday* and *Saturday, September 26* and *27.* All exhibits, of schools as well as of individuals, must be brought to the Brooklyn Botanic Garden before 12 o'clock, *Friday, September 26.* The exhibits will be judged at 1 o'clock on that afternoon, and will be open for public schools at 2 p.m., Friday, when classes are invited to come with their teachers. The exhibit will be open to the general public on Friday afternoon and on Saturday from 10 to 4. After 4 o'clock on Saturday after-

noon the exhibitors may remove their exhibits. Prizes will be presented on Saturday afternoon, *October 18*, at 2:30 o'clock.

D. Seeds for School and Home Planting.—In order to assist the above work, penny packets of seeds are put up by the Botanic Garden for children's use. In the early spring, lists of these seeds, conditions for entry as an exhibitor, and other information may be secured on application to the *Curator of Elementary Instruction.*

E. Conferences.—Conferences may be arranged by teachers and principals for the discussion of problems in connection with gardening and nature study. The last Monday afternoon of each month will be reserved for such conferences: appointments must be made in advance. Address Miss Ellen Eddy Shaw.

F. Study and Loan Material.—To the extent of its facilities, the Garden will provide, on request, various algae and protozoa, as well as living plants and seedlings, leaves and twigs, or other plant parts for study. Where containers are necessary, as in the case of the algae and protozoa, they must be furnished by the school. Petri dishes will, on request, be filled with sterilized nutrient agar ready for use in the study of bacteria and molds. They should be delivered to the Garden, clean, and in general one week before the agar is desired. In all cases arrangements must be made by the teachers for calling for such material.

Teachers may also arrange to have various physiological experiments or demonstrations conducted at the Garden for the benefit of their classes. Communications in regard to these matters should be addressed to the *Curator of Public Instruction.*

G. Loan Sets of Lantern Slides.—Sets of lantern slides have been prepared for loan to the schools. Each set is accompanied by a short syllabus of explanatory nature. In all cases these sets must be called for by a special messenger and returned promptly in good condition. The subjects now available are as follows. Other sets are in preparation.

1. Plant Life
2. Spring Wild Flowers
3. Common Trees
4. Fall Wild Flowers
5. Forestry

II. PUBLIC LECTURES AND DOCENTRY

A. Lectures

Sundays at 3:30 p.m.

The lectures in the spring of 1925 will follow the same general plan which has proven so acceptable thus far in 1924. Particular plants or groups of plants will be treated by specialists, and the lectures will be followed by practical demonstrations in the Garden, using the plants themselves as illustrations, the lecturer leading the discussion. The subjects and speakers at these spring lectures will be announced later.

In order to avoid confusion and to prevent annoyance both to the audience and to the lecturer, it has been found imperative to adopt the following regulations for admittance to the lectures:

1. Children under 12 will not be admitted unless accompanied by an adult.

2. Entrance doors will be closed at 3:30.

3. Late comers will be admitted at 3:45, after which time admission must be refused.

Fall Lectures, 1924

1. September 21. Asters and other herbaceous perennials. Mr. H. E. Downer, Horticulturist, Vassar College. (*Lecture and Garden Demonstration.*)

2. September 28. Waterlilies. Mr. Charles L. Tricker, Horticulturist. (*Lecture and Garden Demonstration.*)

3. October 5. Cannas. Messrs. Antoine and Louis Wintzer of the Conard and Jones Co. (*Lecture and Garden Demonstration.*)

B. Docentry

To assist members and others in studying the collections the services of a docent may be obtained. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted. This service is free of charge to members; to others there is a charge of 50 cents per person. For information concerning membership in the Botanic Garden see page 3 of the cover of this Prospectus.

III. COURSES OF INSTRUCTION

A. Children's Gardens: Nature Study

For the work in Children's Gardening and Nature Study the following equipment is available:

1. *The Children's Gardens,* on a piece of land about three-quarters of an acre in extent, in the south-east part of the Botanic Garden, divided into about 150 plots which are used throughout the season for practical individual instruction in gardening.

2. *The Children's Building,* at the north end of this plot, containing rooms for consultation and for the storage of tools, seeds, notebooks, special collections, etc.

3. *The Instructional Greenhouses,* three in number, for the use of juvenile as well as adult classes for instruction in plant propagation and related subjects.

4. Two large *Classrooms,* (in addition to the Boys' and Girls' Club Room in the Laboratory Building), equipped with stereoscopes and views, a stereopticon, plant collections, economic exhibits, models, and other apparatus and materials for instruction.

5. Three *Laboratory Rooms,* with the usual equipment for plant study.

6. The *Auditorium,* on the ground floor, capable of seating 570 persons, and equipped with a motion-picture lantern and stereopticon.

In addition to these accommodations, the dried plant specimens in the herbarium and the living plants in the conservatories and plantations are readily accessible, while the main library and children's library, which contain a comprehensive collection of books on every phase of gardening and plant life, may be consulted freely at any time.

1. *Courses for Children*

The following courses are open to all boys and girls. Enrollment in these courses entitles the boy or girl to membership in the Boys' and Girls' Club of the Brooklyn Botanic Garden. This club, having an active membership of about 1,000, meets four times a year for discussion of subjects related to plant life. Papers, by

members, on various botanical and horticultural subjects are read at these meetings, and the speakers are then entitled to a silver pin, providing they have taken courses of study at the Garden extending over at least six months. For announcement concerning Children's Room see page 17.

A1. Fall Greenhouse Work.—The following courses are self-explanatory and are for both beginners and advanced students:

Class A.—Open to boys and girls who have never taken any greenhouse work before. Bulbs used: narcissus, oxalis, primrose; also geranium cuttings. *Saturday* mornings at 9:15. *Fee, fifteen cents. October 11 to December 13.* Miss Hickok.

Class B.—Open to boys and girls over thirteen years of age. Subjects studied: hyacinth, Easter lily, calla lily, the botany of common cultivated plants, etc. *Fee, twenty-five cents. Saturday* mornings at 10, *October 11 to December 13.* Miss Hammond.

Class C.—Open to boys and girls who have been in at least two fall bulb classes before this. This class is for advanced work. The bulbs used will be hyacinth, tulip, narcissus, oxalis. Geranium cuttings and primroses will also be used. Time of class, 10:30, *Saturday* mornings. *Fee, fifteen cents. October 20 to December 1.* Miss Hammond.

Class D.—Open to any boy or girl. Subject: the making of garden Christmas presents. There will be a choice of gifts. Some of the articles made will be the following: a flower basket, seed packet, flower book-mark, painted pot and plant to go in it, flower calendar, wooden box with flower design, etc. *Saturday* mornings at 10:30. *Fee, twenty-five cents. October 11 to December 13.* Miss Hickok.

Class E.—The Dalton Method as applied to greenhouse and garden work. The members of this class will be selected by the teacher. *Fee, twenty-five cents.* Miss Hammond.

A2. Junior Gardeners' Course.—This is a course for boys 14–17 years of age. Lessons are given in the care of border and other flower beds, in the weeding and care of small vegetable gardens, in mowing and watering lawns, repotting plants, etc. This is planned to fit boys for summer work and to enable them to obtain positions. Hours to be arranged. *Fee, fifty cents.*
Miss Turner.

A3. Preparation for the Outdoor Garden.—The following classes are open to boys and girls during the spring of each year. The courses are planned for a better understanding of plant life and so that the outdoor garden may become a more intelligent piece of work. On account of limited space in the Children's Greenhouse, classes are limited to twenty. The fee for each course is *fifteen cents* to cover the cost of material.

Boys' Spring Course.—(a) *Saturday* mornings, 9–10:15, *February 7 to April 4.* (b) *Saturday* mornings, 10:30–11:30, *February 7 to April 4.*

Girls' Spring Course.—(a) *Saturday* mornings, 9–10:15, *February 7 to April 4.* (b) *Saturday* mornings, 10:30–11:30, *February 7 to April 4.*
Miss Hammond, Miss Hickok.

A4. Advanced Work for Older Boys and Girls.—How to raise plants, mix soils, transplant, start seedlings for outdoor gardens, etc. Boys and girls who have taken spring courses under A4 are eligible for advanced work. The fee for the course is *twenty-five cents.* Each student may take home his plants and seedlings. This course is open to both boys and girls over twelve years of age. *Saturday* mornings at 9:30, *January 10 to March 28.*
Miss Turner.

A5. The Beginners' Garden.—Open annually to 50 boys and girls who have never had instruction in gardening at the Brooklyn Botanic Garden. This course takes up the subject of the small garden, what to plant, how to plant it, care, replanting, etc. *Application for plots should be made in person or in writing before March 1.* Size of plots 8 ft. by 10 ft. All crops belong to the individual. *Fee, twenty-five cents. Saturday* mornings, 9–12, *April 4 to October 3.*
Miss Hickok.

A6. Second Year Gardens.—Open to 50 boys and girls who have had one or more seasons at the Brooklyn Botanic Garden—a continuation of Course A3. Registration should be made before September 1 of each year for the following year. *Fee, twenty-five cents. Saturday* mornings, 9–12. *April 4 to October 3.*
Miss Hammond.

A7. Junior Garden Assistants.—Open to older boys and girls, or to those who have mastered Courses A2 and A4. Size of plot 10 ft. by 20 ft. *Fee, fifty cents.* These gardens are for the raising of vegetables. The work is in the nature of a project, "How much can one raise on a plot 10 ft. by 20 ft.?" Hours to be arranged. The student must put in at least two periods a week during the summer vacation, and, if possible, three. Registration date: *April 4.*

Miss Turner.

A8. Advanced Nature Work.—A course designed for those older boys and girls who have taken Courses A1–A5. Herbarium specimens will be prepared and the simpler principles of plant classification studied. Projects will be assigned to individuals. *Open only to pupil assistants of the Garden.* Hours to be arranged.

Miss Hammond.

A9. Nature Study for Boy Scouts, Girl Scouts, Camp Fire Girls, Scout Leaders, and Others.—Short courses of at least four periods each, with talks, demonstrations, and field trips in the grounds of the Botanic Garden and Prospect Park to study trees, shrubs, etc. The instruction and schedule dates will be adapted to meet the needs of the various groups that apply. *Open only to groups of at least ten persons.* Hours to be arranged.

Dr. Graves, Miss Hammond, and assistants.

A10. Special Work for High School Pupils.—A course in gardening or greenhouse work adapted for high school pupils. Classes to be arranged for by the high school teacher.

Miss Shaw, Miss Turner.

2. Courses for Teachers

The following brief courses are designed primarily for teachers who wish to extend their knowledge of nature study and gardening for use in their school work, without taking the longer courses described under B, page 9. It should be noted that only the latter courses are accepted by the Board of Education for teachers' credits.

A21. Greenhouse Work for Teachers.—Not given in 1925.

A22. The School Garden.—A series of fifteen practical lessons and demonstrations on the school garden: how to lay it off, plant

it, kinds of seeds to use, school garden management, etc. *Fee, three dollars,* to cover cost of materials. *Tuesdays, 4 p.m., February 3 to May 12.* Miss Shaw, Miss Turner.

A23. Spring Nature Study for the Classroom.—This course of three lessons will acquaint the teacher with common nature study material which may be taken into the classroom during the spring-time. Demonstration materials will be given to members of this class. The work will be based on the syllabus of nature study for the schools of New York City, and will be entirely practical. *Fee, two dollars. Mondays, 4 p.m., May 11–25.* Miss Hammond.

A24. Fall Garden Work.—Three lessons on home plants; window boxes; indoor planting of bulbs; the outdoor bulb bed. *Fee, one dollar. Mondays, 4 p.m., October 6–20–27.*

Miss Shaw, Miss Hickok.

A25. Fall Nature Study.—This course is a complement to the spring nature study work and the material used will be the common material one would use in classroom work, showing seed dispersal, evergreens, deciduous trees, etc. Such subjects as Nature's preparation for winter will be covered. Three lessons. *Fee, one dollar. Thursdays, 4 p.m., October, 16–30.* Miss Hammond.

A26. Advanced Agriculture.—A course of advanced work for those who have taken "B 3, Principles of Agriculture and Horticulture." Fifteen weeks of practical work in the greenhouse. *Limited to 15 members. Fee, eight dollars. Tuesdays, 4 p.m., beginning October 14.* Miss Shaw.

B. Courses for Teachers of Children's Gardening and Nature Study

The courses for teachers in children's gardening are planned not only to prepare for garden work, but for the teaching of nature stuly as well. The courses are so arranged that they emphasize not only the theory of each subject, but its actual practice, either in classroom, greenhouse, garden, or field. At the same time the work is correlated to meet the needs of each grade of the elementary school. There is an increasing demand for good nature study work in our schools, and we make a special point of giving

simple, definite, helpful work, grading it so that it applies directly to the immediate needs of our own city schools. Practice with classes of children of different ages is given in all this work.

The requirements for entrance are a certificate from a city training or a normal school, a college diploma, or several years of certified successful teaching. These courses may be completed during one year, or may be extended over a period of two or more years. The *fee for the entire course is thirty-five dollars,* payable in full at the time of registration, or course by course in advance. No money will be refunded if the student drops the work, and no monetary allowances will be made for courses taken at other institutions, although time allowances will be made.

Special stress is put upon the outdoor garden practice. This practice is of two kinds: (1) Practice with children. There are one hundred and fifty children in our outdoor garden, and every opportunity is given for practice in working with children and for the solving of problems connected with this phase of the work. (2) Practice in the teacher's garden. Each member of the class has a garden of her own and works it herself, thus performing all gardening operations to be taught later to children.

To those who satisfactorily complete this course a certificate will be given. *The five courses offered in children's gardening constitute one unit.* Open only to teachers.

These courses have been accepted by the Board of Education of the City of New York for teachers' credits as follows:

1. Any of the courses will be accepted toward meeting clause "b" of the conditions of eligibility for high-school license in biology.

2. The course in Pedagogy of Botany and Educational Principles of Children's Gardening (**B4**) will be accepted as a satisfactory 30-hour course in Pedagogy toward meeting the requirement of 60 hours' work in Pedagogy in lieu of the written test in Principles and Methods of Teaching for Promotion License.

3. This course will be accepted as a pedagogical course, and either of the other four courses will be accepted as an academic course toward meeting the conditions of exemption from the academic paper in the examination for license as assistant to prin-

cipal. Such exemption is granted to those who offer 120 hours of satisfactory work, 60 of which must be in the Science of Education and 60 in some branch of literature, science, or art, such 120 hours' work not being accomplished wholly within one academic year.

These courses have also been accepted by the Brooklyn Teachers' Association and appear in its syllabus of courses.

The individual student may apply at any college for credits on these courses, which will be granted according to individual merit.

B1. General Botany.—Thirty sessions. A course designed to make clear the fundamental principles of morphological and physiological botany. With a view to correlation with the other courses described below, emphasis is laid upon the higher plants, particularly their classification and physiology, and in connection with the latter subject a consideration of plant diseases from a practical as well as theoretical viewpoint is also included. *Fee, $5. Thursdays,* 4 p.m., beginning *October 2.* Dr. Graves.

B2. Nature Study.—Thirty sessions. This course covers the plant material used in teaching nature study, and includes the identification of the common trees, shrubs, plants, wild flowers, and weeds. Mounts, charts, and diagrams are made. The student becomes familiar with the actual material. The course is entirely practical, work being done in both field and laboratory. Two hours of class work are credited as one hour. *Fee, $5. Tuesdays,* 4 p.m., beginning *September 23.* Miss Hammond.

B3. Principles of Agriculture and Horticulture.—Thirty sessions. This course will be especially helpful to teachers. The principles of horticulture are considered and applied in a practical way through greenhouse, laboratory, and lecture work. The greenhouse work includes the following subjects: plant propagation by means of bulbs, rhizomes, roots, seeds, etc.; the care of the greenhouse; house plants; window-box materials; fertilizers. Insect and fungous pests, grafting and pruning are also included from both a practical and a theoretical point of view. *Fee, $7. Wednesdays,* 4 p.m., beginning *September 24.*

Miss Shaw and Mr. Free.

B4. Pedagogy of Botany and Educational Principles of Children's Gardening and Nature Study.—Thirty sessions. Discussion of the mental processes involved in learning and in teaching science and the fundamental principles which underlie and point the way to laboratory and field work. After this a course of study in gardening and nature study, based on the school syllabus, is worked out and the basic psychological and pedagogical principles discussed. This course includes all the modern phases of the subject and is so arranged that it may be applied directly in classroom work. *Fee, $5. Thursdays,* 4 p.m., beginning *September 25. (Will not be given in 1925–6.)*

Dr. Gager and Miss Shaw.

B5. Garden Practice.—Thirty sessions. This course is entirely practical and includes all the outdoor work of the student in his own garden, applying the principles of agriculture and gardening, work with children in the garden, basketry and woodwork. Ninety hours is the minimum in this course, but students may profitably put in a greater number of hours to the maximum of 630 hours, or seven credits. *Fee, $5: for summer practice, fee $8 additional. Tuesdays,* 4 p.m. *(Not given in 1924–5.)* Miss Shaw.

C. Courses for the General Public

The following courses are open to any one who has a general interest in plants. Teachers are welcome. They are *free to those enrolled as members of the Botanic Garden;** for others a small fee is required, as specified. Registration should be made with the instructor in person or by mail at least one week before the course opens, in order that adequate material, etc., may be provided. *No course will be given when less than six apply.*

1. *Fall Courses*

C4. Gardening in the Fall.—Six lessons, with practical work in the greenhouse, on the methods of making cuttings, the various kinds of bulbs for fall planting, their treatment and care, the proper management of house plants and a discussion of the kinds

* For information concerning the conditions of membership in the Brooklyn Botanic Garden consult the third page of the cover of this Prospectus.

suitable for cultivation. *On account of restricted space in the greenhouse, this class must be limited to 40. Registration according to the order of application. Fee, $2.50. Thursdays,* 4 p.m., *September 25 to October 30.* Mr. Free.

C5. Trees and Shrubs in their Winter Condition.—Eight outdoor lessons in the Botanic Garden and elsewhere in Greater New York on the characteristics of our common trees and shrubs, both native and cultivated, emphasizing their distinguishing features in the winter condition. *Fee, $2. Saturdays,* 2:30 p.m., *September 27 to November 15.* Dr. Graves.

C6. Fall Flowers and Fruits.—Six outdoor lessons in the Botanic Garden. This is a continuation of Course C 8, given in the spring on the flowers and ferns, and takes up in a similar way the study of the native and cultivated fall flowers and fruits. *Fee, $1.50. Tuesdays,* 4 p.m., *September 23 to October 28.* Dr. Gundersen.

2. *Spring Courses*

C1. Plants in the Home.—How to grow them. Five talks with demonstrations. Practice in potting, mixing soils, making cuttings, etc. This course deals with the principles to be followed in raising plants. The members of the class have the privilege of keeping the plants they have raised. *Fee, $2.50. (Not given in 1925.)* Mr. Free.

C3. The Flower Garden.—Making the most of it. Five lessons. How to improve soils and get results from planting; old-fashioned flowers; annuals; summer bedding; vines for screening unsightly objects; rose culture; growing of ornamental shrubs; pruning; how to make a lawn and maintain it. *Fee, $2. Thursdays,* 4 p.m., *February 26 to March 26.* Mr. Free.

C7. Evolution in the Flowering Plants.—Three illustrated lectures, followed by visits to the conservatories. 1. Comparison of vegetative characters in the higher plants. 2. The structure of flowers: perianth and stamens. 3. The structure of flowers: carpels and ovules. *This course is free to all interested* and is especially recommended to those who are planning to take Course

C8, Spring Flowers and Ferns. *Fridays,* 4 p.m., *March 6 to March 20.* Dr. Gundersen.

C8. Spring Flowers and Ferns.—Eight outdoor lessons in the Botanic Garden on the identification and classification of plants. The structure of flowers and the characters of plant families are studied. Members should bring a small magnifying glass. *Fee, $2.50. Fridays,* 4 p.m., *May 1 to June 19.* Dr. Gundersen.

C9. Trees and Shrubs of Brooklyn and Vicinity.—Ten outdoor lessons at the Garden and elsewhere in Greater New York, the principal object being to gain a ready acquaintance with the common trees and shrubs of the eastern United States, which are well reprsented in this region. The species are considered in systematic order, and the features pointed out by which they may be most easily recognized; also their habits, rate of growth, economic value and use, methods of planting and propagation; importance in forestry, horticulture, or landscape art. *Limited to 50 members enrolled in the order of application. Fee, $3.00. Saturdays, 2*: 30 p.m., *April 10 to June 12.* Dr. Graves.

D. Consultation and Independent Investigation

1. *Consultation*

Consultation and advice, and the facilities of the laboratories, library, and herbarium are freely at the service of members of the Botanic Garden and others with special problems relating to plants or plant products, especially in the following subjects:

1. **Plant diseases** (phytopathology) and classification of fungi (mycology). Dr. Reed.

2. **Plant breeding** and allied subjects (genetics and experimental evolution). Dr. White.

3. **Plant geography** (phytogeography) **and ecology.** Mr. Taylor.

4. **Classification and identification of flowering plants** (systematic botany). Dr. Gundersen.

5. **The growing of cultivated plants** and their arrangement; also their adaptation to soils, climate, and other factors (horticulture and gardening). Mr. Free.

2. Investigation *

For the following research courses, open to those properly qualified for independent investigation, there is a charge covering all expenses, including laboratory fee, of *$30 for each full course* of 100 credit hours, and *$20 for each half course* of 50 credit hours.

E6. Research in Mycology and Plant Pathology.—Independent investigation of problems relating to fungi and fungous diseases of plants. Dr. Reed.

E7. Research in Plant Genetics.—Independent investigation of problems of variation and heredity, including that phase of cytology having a direct bearing on the subject matter of genetics. Dr. White.

E8. Research in Forest Pathology.—Independent investigation of the diseases of woody plants. Dr. Graves.

E9. Research in Systematic Botany of the Flowering Plants. Dr. Gundersen.

IV. OTHER EDUCATIONAL FEATURES

Plantations

The plantations comprise several sections, as follows:

1. General Systematic Section (trees, shrubs, and herbaceous plants not native within 100 miles of Brooklyn).
2. The Local Flora (native wild flower garden).
3. Ecological Garden.
4. Rock Garden.
5. Children's Garden.
6. Japanese Garden, etc.

* Courses of graduate rank offered by the Botanic Garden, when approved by the Faculty of the Graduate School of New York University, are listed as courses in the Graduate School, and are given the same credit as other graduate courses. Properly qualified students who take these courses may present them in satisfaction of the requirements for advanced degrees given by the University. Graduate credit has also been allowed elsewhere for such advanced work done at the Garden.

As noted under *Docentry,* arrangements may be made for viewing the plantations under guidance. They are open free to the public daily from 8 a.m. until dark; on Sundays and holidays from 10 a.m. until dark.

Conservatories

The Garden conservatories contain a collection of tender and tropical plants. Of special interest for teachers of nature study and geography are the following useful plants from the tropics and subtropics: banana, orange, lemon, lime, kumquat, tamarind, West Indian cedar (the source of the wood used for cigar boxes), eucalyptus, Manila hemp, sisal, pandanus (source of the fiber used for making certain kinds of fiber hats), fig, grape vines from north and south Africa, date palm, cocoanut palm, chocolate tree, coffee, tea, ginger, bamboo, mahogany, balsa, cocaine plant, black pepper, cardamom, olive, pomegranate, logwood, durian, mango, sugar cane, avocado (so-called "alligator pear"), West Indian and other rubber plants, banyan, religious fig of India, and numerous others.

The Conservatories are open April 1 to November 1, 10 a.m.–4:30 p.m. (Sundays, 2–4:30); November 1 to April 1, 10 a.m.–4 p.m. (Sundays, 2–4).

Herbarium

The Garden herbarium consists at present of over 184,000 specimens, including phanerogams, ferns, mosses, liverworts, lichens, parasitic and other fungi, algae, and myxomycetes. This collection may be consulted from 9 a.m. until 5 p.m. by those interested, and specimens submitted will be gladly identified.

Library

The rapidly growing library of the Garden comprises at present over 9,950 volumes and over 6,600 pamphlets. This is not a circulating library, but is open free for consultation to all persons from 9 a.m. until 5 p.m. (Saturdays, 9 to 12). Over 700 periodicals and serial publications devoted to botany and closely related subjects are regularly received.

Laboratory Building

The Laboratory Building contains (besides offices of administration and the Library and Herbarium mentioned above) four laboratory rooms, a culture room, two classrooms with stereopticon and other equipment for instruction, a room for the installation of temporary exhibits, six private research rooms, and an auditorium seating about 570, and equipped with motion picture machine, stereopticon and lecture table supplied with water, gas, and electric current for experimental lectures.

Instructional Greenhouse

A range of three greenhouses, each about 20 x 30 feet, is provided for the practical instruction of children and adults in plant propagation and other subjects.

Children's Room

A gift of $1,500 in 1921 from the late Mrs. George D. Pratt, supplemented in 1923 by a further gift of $500 from Mr. George D. Pratt, has made it possible to provide a beautifully decorated room for the use of the Boys' and Girls' Club. Any boy or girl who is enrolled, or has been enrolled, in any of the children's classes at the Garden is eligible for membership in this club, which now numbers about 1,000 active members. The room contains shelves for a nature-study library, of which a nucleus has already been secured, and is equipped with stereoscopic views, photographs, and preserved and living specimens of plant life, for the instruction and entertainment of boys and girls. The room is open free to all children. Contributions of specimens and of books on nature study and closely related subjects will be most welcome.

Children's Garden Building

This is located in the northern part of the Children's Garden plot and contains a conference room and rooms for the storage of garden tools and implements. Various collections of plants, seeds, and insects of economic importance in the garden are accessible here for consultation by the children. North of the Children's

Building is a plot planted to ornamental shrubs and herbaceous perennials for the instruction of the children.

Children's Gardens

A plot of about three quarters of an acre in the southeast part of the Botanic Garden has been set aside for the theoretical and practical instruction of children in gardening. The larger part of this area is laid out in garden plots which will accommodate about 150 children.

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GENERAL INFORMATION

Membership.—All persons who are interested in the objects and maintenance of the Brooklyn Botanic Garden are eligible to membership. Members enjoy special privileges. Annual Membership, $10 yearly; Sustaining Membership, $25 yearly; Life Membership, $500. Full information concerning membership may be had by addressing *The Director, Brooklyn Botanic Garden, Brooklyn, N. Y.* Telephone, 6173 Prospect.

The Botanic Garden is open free to the public daily from 8 a.m. until dark; on Sundays and Holidays open at 10 a.m.

Entrances.—On Flatbush Avenue, near Empire Boulevard (Malbone Street), and near Mt. Prospect Reservoir; on Washington Avenue, south of Eastern Parkway and near Empire Boulevard; on Eastern Parkway, west of the Museum Building.

The street entrance to the Laboratory Building is at 978 Washington Avenue, opposite Montgomery Street.

To Assist Members and others in studying the collections the services of a docent may be obtained. This service is free of charge to *members of the Botanic Garden;* to others there is a charge of 50 cents per person. Arrangements must be made by application to the Curator of Public Instruction at least one week in advance. No parties of less than six adults will be conducted.

To Reach the Garden take Broadway (B.M.T.) Subway to Prospect Park station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St. John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

PUBLICATIONS
OF THE
BROOKLYN BOTANIC GARDEN

RECORD. Established, January, 1912. An administrative periodical issued quarterly. Contains, among other things, the *Annual Report* of the director and heads of departments, special reports, announcements of courses of instruction, miscellaneous papers, and notes concerning Garden progress and events. Free to members of the Garden. To others one dollar a year; 25 cents a copy.

MEMOIRS. Established, July, 1918. Published irregularly.

Volume I, *Dedication Papers:* comprising scientific papers presented at the dedication of the laboratory building and plant houses, April 19–21, 1917. Price $3.50, plus postage.

Volume II. The vegetation of Long Island. Part I, The vegetation of Montauk: A study of grassland and forest. Price $1.00, plus postage.

CONTRIBUTIONS. Papers originally published in botanical or other periodicals, reissued as "separates," without change of paging, and numbered consecutively. This series includes occasional papers, as well as those embodying the results of research done at the Garden, or by members of its staff or students. Twenty-five numbers constitute one volume. Price 25 cents each, $5.00 a volume.

27. *The origin of new varieties of Nephrolepis by orthogenetic saltation. II. Regressive variation or reversion from the primary and secondary sports of Bostoniensis.* 18 pages, 6 plates. 1922.

28. *Botanical exploration in Bolivia.* 13 pages. 1922.

29. *Anthracnose of the Boston fern.* 7 pages, 2 plates. 1923.

30. *Varietal resistance and susceptibility of Sorghums to Sphacelotheca Sorghi (Link) Clinton and Sphacelotheca Cruenti (Kühn) Potter.* 12 pages, 2 plates. 1923.

31. *The Melanconis disease of the butternut (Juglans cinerea L.).* 23 pages, 2 plates, 5 figs. 1923.

32. *New bud sports of Nephrolepis.* 21 pages, 2 plates, 4 figures. 1923.

35. *Factors influencing infection of Hordeum sativum by Ustilago hordei.* 26 pages, 2 plates, 7 figures. 1924.

36. *Influence of environmental factors on the infection of Sorghums and Oats by smuts I. Experiments with covered and loose kernel smuts of Sorghum.* 17 pages, 7 figures. 1924.

LEAFLETS. Established, April 10, 1913. Published weekly or biweekly during April, May, June, September, and October. The purpose of the *Leaflets* is primarily to give announcements concerning flowering and other plant activities to be seen in the Garden near the date of issue, and to give popular, elementary information about plant life for teachers and others. Free to members of the Garden. To others, fifty cents a series. Single numbers 5 cents each.

GUIDES to the collections, buildings, and grounds. Price based upon cost of publication.

SEED LIST. Issued in December of each year.

AMERICAN JOURNAL OF BOTANY. Established, January, 1914. Published in coöperation with the BOTANICAL SOCIETY OF AMERICA, monthly, except during August and September. Subscription, $6.00 a year.

ECOLOGY. Established, January, 1920. Published quarterly in coöperation with the ECOLOGICAL SOCIETY OF AMERICA. Subscription, $4.00 a year.

GENETICS. Established, January, 1916. Bi-monthly. Subscription, $6.00 a year.